TI 2-NDC-1

TECHNICAL MANUAL

OPERATION, PRINCIPLES OF OPERATION
AND FAULT VERIFICATION

UNITED STATES
NATIONAL DATA CENTER

26 JULY 2001

LIST OF EFFECTIVE PAGES

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GLOSSARY

TERM	DEFINITION
A/MIS	AFTAC Mission Information System
ADSN	AFTAC Distributed Subsurface Network
AFTAC	Air Force Technical Applications Center
AI	Area of Interest
AOC	AFTAC Operations Center
ARS	Analyst Review Station
ASN	AFTAC Southern Network
BARM	Broad Area Regional Monitoring
BB	Broadband
C2	Command and Control (Guard)
CDE	Common Desktop Environment
CF	Complexity Factor
CMR	Center for Monitoring Research
COL	Creates an Origin and Locates the origin
COLA	Creates an Origin, Locates the origin, and Aligns the channels
CommAgent	Communications Agent
COTS	Commercial Off-the-Shelf
CSS	Center for Seismic Studies
CTBT	Comprehensive Test Ban Treaty
DACS	Distributed Applications Control System
DAM	Data Acquisition Manager
DB	Database
DFX	Detection and Feature Extraction Program
DIP	Dual Inline Package
DMS	Data Management Services
DTC	Data Transaction Center
EEA	Event Evaluation Analyst
email	Electronic Mail
GA	Global Association
GMT	Greenwich Mean Time (system time)
GPM	Global Processing Mode
GUI	Graphical User Interface
HAL	Hydroacoustic Analysis
HDT	Hydrodisplay Tool
HQ	Headquarters
HYDR	Hydroacoustic Station Intervals
HYDRO	Hydroacoustic
Hz	Hertz
ID	Identification
IDC	International Data Centre
IMS	International Monitoring System
IP	Internet Protocol

GLOSSARY (Cont)

TERM	DEFINITION
IPB	Illustrated Parts Breakdown
IPB	Illustrated Parts Breakdown
IPC	Interprocess Communication
IRIS	Incorporated Research Institutions for Seismology
ITI	Identifying Technical Instruction
JBOD	Just a Bunch of Disks
LAN	Local Area Network
LANL	Los Alamos National Laboratory
LIFO	Last-In-First-Out
LP	Long Period
LQ	Long Period Detection Love Wave
LR	Long Period Detection Raleigh Wave
MDT	Message Data Terminal
NDC	National Data Center
NEIC	National Earthquake Information Center
NET	Network
NFS	Network File System
OAI	Outside Area of Interest
OPS	Operations
PE	Preliminary Event
Pipeline	Sequence of processes to be applied to a data stream
PM	Process Manager
POC	Point of Contact
Power off	Procedures performed on system hardware
QC	Quality Control
RAID	Redundant Array of Independent Disks
RDBMS	Relational Database Management System
SDV	Standard Deviation
SEA	Seismic Event Analyst
SEED	Scientific Exchange of Earthquake Data
Shutdown	Procedures performed on system software
SMU	Southern Methodist University
SNL	Sandia National Laboratory
SNR	Signal-to-Noise Ratio
SOM	System Operations Manager
SP	Short Period
SPOT	Spotlight Seismic Station Intervals
SQL	Structured Query Language
TCP/IP	Transmission Control Protocol/Internet Protocol
TI	Technical Instruction
UCSD	University of California, San Diego
UDP/IP	User Datagram Protocol/ Internet Protocol

GLOSSARY (Cont)

TERM	DEFINITION
US NDC	United States National Data Center
USAEDS	United States Atomic Energy Detection System
USGS	United States Geological Survey
VLAN	Virtual Local Area Network
WAN	Wide Area Network
WFS	Waveform Server
WS	Workstation
ZAS	Zoom, Align, and Sort

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INTRODUCTION

Due to the amount of the information necessary to operate and maintain the United States National Data Center (US NDC), it was necessary to divide the technical instruction (TI) into two separate manuals. The manuals are divided into two categories: Operations and Maintenance. Some chapters will only be contained in this manual, while others will appear in both manuals depending on their relationship to operations or maintenance.

This TI contains the procedures to operate the US NDC. It is intended to be used by operator personnel and is written from an operator's perspective.

Chapter 1 describes the equipment and its purpose in general terms. Publications related to operation of the equipment are also identified.

Chapter 2 is contained in TI 2-NDC-2.

Chapter 3 provides detailed operating procedures for the US NDC.

Chapter 4 discusses the detailed principles of operation for each subsystem of the US NDC from a functional viewpoint. Also included is a description of the processes and data flow.

Chapter 5 presents fault verification data. The fault verification data allows the operator to identify the most likely suspected problem prior to contacting the appropriate maintenance personnel to troubleshoot or remove and replace the faulty component.

Chapters 6 and 7 are contained in TI 2-NDC-2.

All data necessary to maintain the US NDC (e.g., troubleshooting and removal and replacement procedures), as well as illustrated parts breakdowns and circuit diagrams, are contained in TI 2-NDC-2.

STANDARD CONVENTIONS

UNIX Conventions

This documentation assumes some knowledge of the UNIX operating system which runs on the workstations. In this document, interactive (typed) input is shown in **`Courier bold`** font. Computer prompts and responses are presented in `Courier` font. Comments are added in parentheses in Helvetica font. The symbol ↵ is used for <enter> or <return> for keyboard inputs. The following is an example of these formats:

`login:` **`username`**↵ (Enter username)

Mouse Conventions

The workstation mouse has three buttons: left, middle, and right. In general, use the left mouse button unless specified otherwise.

UNIX File and Path Name Conventions

Throughout the document references to UNIX file names, as well as the path, will be specified in `Courier font` without italics. For example, `/adsn/config/status_monitor.par` would refer to the status_monitor.par file in the /adsn/config directory.

Pull-down Menus

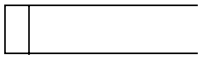
Some procedures contained throughout this document require the operator to select a pull-down menu, then select an item within that pull-down menu. When this occurs, the menu item to be selected by the operator appears in **Helvetica bold** font, immediately followed by a double arrow signifying the pull-down menu, immediately followed by the next selection also in **Helvetica bold** font. The following is an example of this format:

a. Select **File⇒Open⇒Latest Interval for AL1** in ARS.

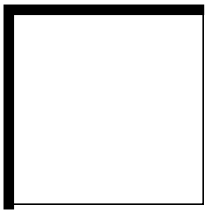
Graphic Symbol Conventions

The following graphic symbols are used in the data flow diagrams contained in this manual.

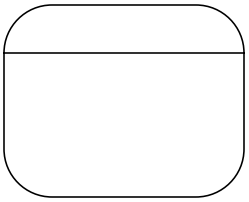
Database File



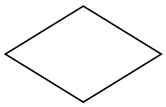
External Entity



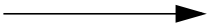
Program



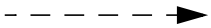
Decision Block



Data Path
(Constant)



Data Path
(Not Constant)



SAFETY SUMMARY

This publication describes procedures which may require the use of chemicals, solvents, paints, or other commercially available material. The user of this publication should obtain the Material Safety Data Sheet (MSDS) Occupational Safety and Health Act (OSHA) Form 20 or equivalent from the manufacturers or suppliers of materials to be used. The user must become completely familiar with the manufacturer/supplier information and adhere to the procedures, recommendations, warnings, and cautions of the manufacturer/supplier for the safe use, handling, storage, and disposal of these materials.

The following are general safety precautions, sample icons, and instructions personnel must understand and apply during the many phases of operation and maintenance to ensure personal safety and health and the protection of Department of Defense (DOD) property.

HAZARDOUS MATERIALS

Warnings for hazardous materials are designed to warn personnel of hazards associated with such items when they come in contact with them during actual use. For each hazardous material used, a MSDS is required to be provided and available for review by users. Consult your local safety and health staff concerning any questions on hazardous chemicals, MSDSs, personal protective equipment requirements, and appropriate handling and emergency procedures.

WARNING AND CAUTION STATEMENTS

Warning and caution statements are strategically placed throughout this text prior to operating or maintenance procedures, practices, or conditions considered essential to the protection of personnel (WARNING) or equipment and property (CAUTION). A warning or caution will apply each time the related step is repeated. Prior to starting any task, the warning or caution included in the text for the task shall be reviewed and understood. The following are examples of warnings and cautions used throughout this document:

WARNING

This instrument produces lethal voltages. Remove all jewelry, watches, and wire rim glasses before working on this instrument. Ensure that power is disconnected before replacing any parts or performing maintenance. Procedures involving lethal voltages are identified by the following symbol:

CAUTION

HANDLING OF ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES

Electrostatic discharge sensitive (ESDS) devices must be handled with certain precautions that must be followed to minimize the effect of static build-up. Consult MIL-STD-1686B. Procedures involving ESDS devices are identified by the following symbol:

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CHAPTER 1

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. Chapter 1 provides general information for the United States National Data Center (US NDC).

1-3. DESCRIPTION AND PURPOSE.

1-4. The US NDC monitors geophysical data to verify compliance with the Comprehensive Test Ban Treaty (CTBT). Established and operated at the Air Force Technical Applications Center (AFTAC), the US NDC primary function is to support US national monitoring and verification capabilities. The US NDC also serves as a gateway between the US and the International Data Centre (IDC) for the exchange of geophysical data recorded by a global network of stations. The US NDC also provides the US academic communities and other authorized scientific organizations with readily accessible, high-quality data for conducting basic and applied research.

1-5. The US NDC system accumulates seismic and hydroacoustic waveforms from sensors distributed worldwide. Once gathered, the waveforms are stored and archived for immediate and delayed processing. The US NDC provides a management capability for the raw waveforms, which allows the data to be analyzed using well-defined geophysical algorithms, and allows the timely detection and identification of man-made events (i.e., nuclear detonations).

1-6. As shown in figure 1-1 and figure 1-2, the US NDC is composed of two systems, the Unclassified and Classified Systems, respectively.

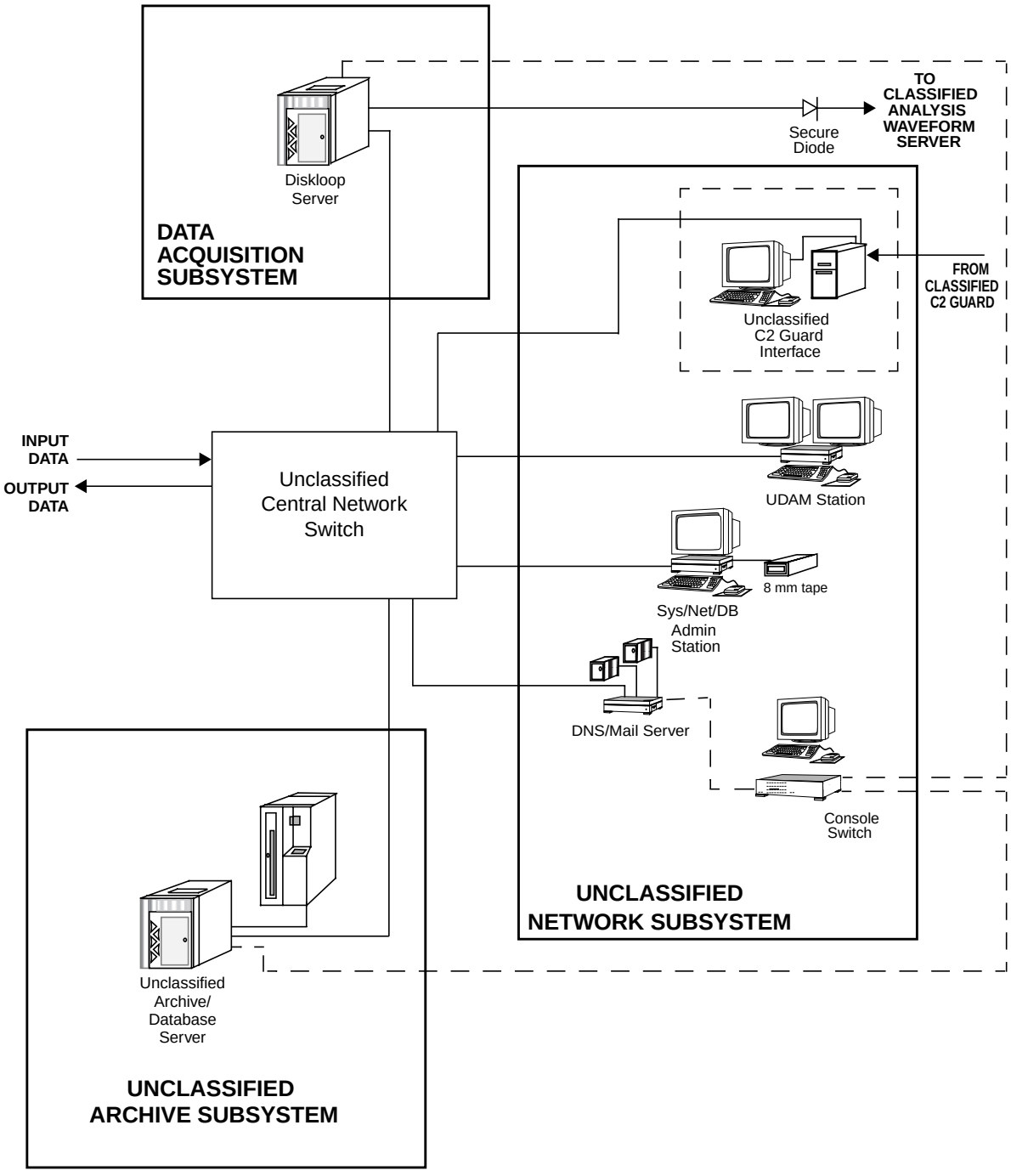

Figure 1-1. US NDC Unclassified System Connectivity

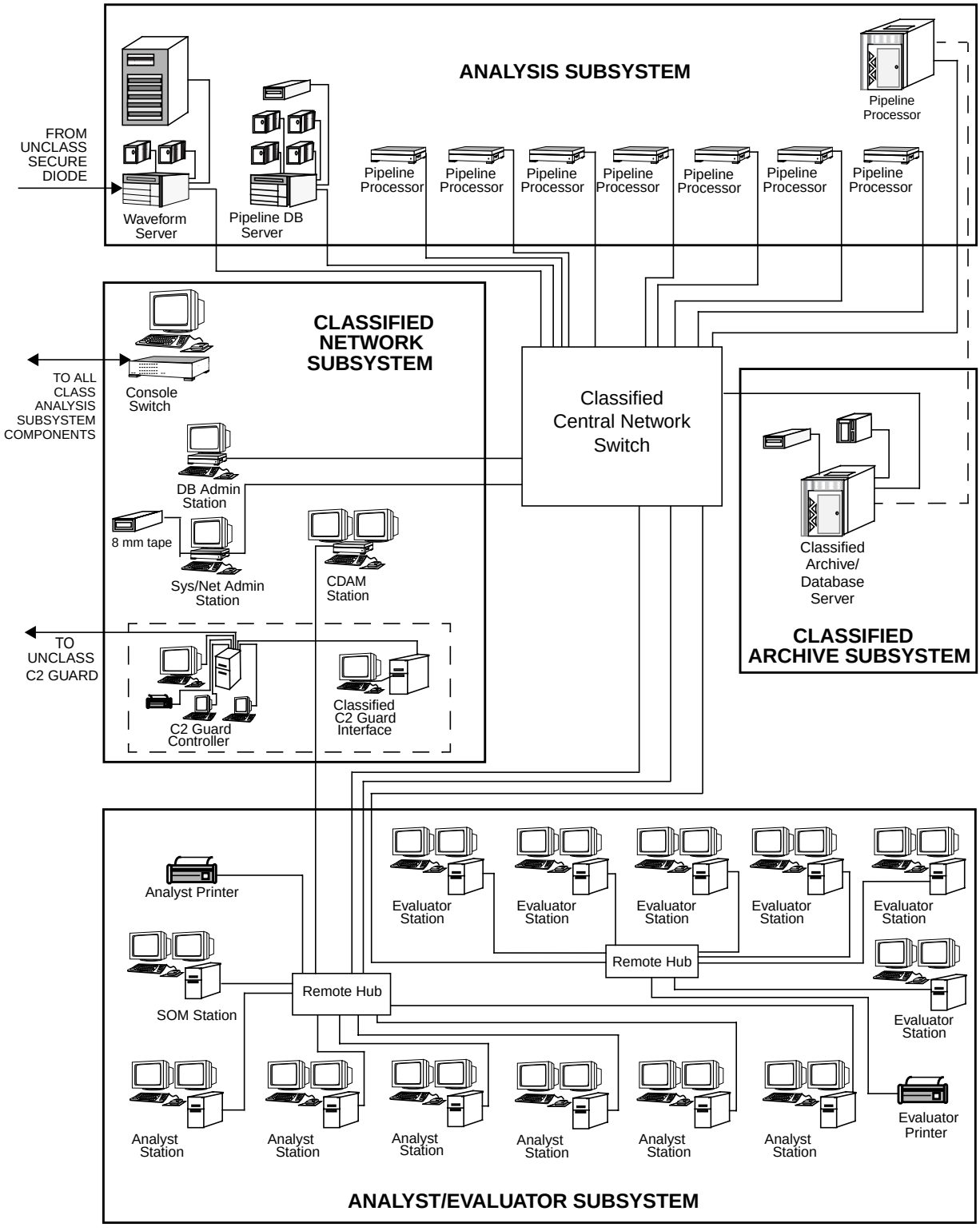

Figure 1-2. US NDC Classified System Connectivity

1-7. UNCLASSIFIED SYSTEM.

1-8. The Unclassified System consists of three subsystems which are further defined in the following paragraphs. The Unclassified System provides:

a. Control and monitoring of unclassified data input to the system.

b. Storage and archiving of unclassified data.

c. Control of data transfer to the Classified System.

1-9. UNCLASSIFIED DATA ACQUISITION SUBSYSTEM. Controls the acquisition of unclassified data from the external sources including the IDC, and controls the forwarding of that data to the Classified Analysis Subsystem, the IDC, and other sites.

1-10. UNCLASSIFIED ARCHIVE SUBSYSTEM. Provides long-term storage (180 days) of data received by the Data Acquisition Subsystem (DAS).

1-11. UNCLASSIFIED NETWORK SUBSYSTEM. Incorporates the workstations for performing unclassified system and database administration, and includes the secure e-mail communication from the Classified System to the Unclassified System through the Unclassified Command and Control (C2) Guard. The Unclassified Network Subsystem includes the DNS/Mail Server which provides domain name services (DNS) and e-mail services.

1-12. CLASSIFIED SYSTEM.

1-13. The Classified System consists of four subsystems which are further defined in the following paragraphs. The Classified System provides:

a. Control and monitoring of data forwarded from the Unclassified System.

b. Data processing for analysis and evaluation.

c. Storage and archiving of data.

1-14. ANALYSIS SUBSYSTEM. Processes raw data received from the Unclassified DAS for signal detection, feature extraction, automatic event building, and preparation of the data for use in the analysis process.

1-15. CLASSIFIED ARCHIVE SUBSYSTEM. Stores and archives raw and processed data.

1-16. ANALYST/EVALUATOR SUBSYSTEM. Provides users with the capability to review and refine currently-available results from automatic processing or interactive analysis.

1-17. CLASSIFIED NETWORK SUBSYSTEM. Includes the workstations necessary for performing classified subsystem administrative functions and the secure communication interface to the Unclassified System through the Classified C2 Guard.

1-18. EQUIPMENT SUPPLIED.

1-19. Table 1-1 lists the equipment supplied for the US NDC system.

1-20. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1-21. Table 1-2 lists the equipment required to operate and maintain the US NDC system, but not supplied.

1-22. LEADING PARTICULARS.

1-23. Table 1-3 lists the logistical characteristics and environmental requirements for the US NDC system. For particulars on individual equipment, refer to the appropriate identifying technical instruction (ITI).

1-24. CAPABILITIES AND LIMITATIONS.

1-25. Table 1-4 lists the capabilities and limitations of the US NDC equipment.

1-26. RELATED PUBLICATIONS.

1-27. Table 1-5 lists the publications referenced throughout this technical instruction (TI) which provide additional information on the US NDC equipment, as well as information on related equipment.

Table 1-1. Equipment Supplied

ITEM	DESCRIPTION	QTY	APPLICATION
1	HARDWARE		
1a	SPARC Ultra 1 Creator P/N A12-UBA1-1E-128AB	2	Unclassified and Classified DAM Station with graphical capabilities.
1b	SPARC Ultra 1 Creator 3D P/N A12-UBA-9E-128AB	7	Pipeline Processors with superior graphical capabilities.
1c	SPARC Ultra 5 Creator P/N A21-UFE1A9J-128AG	3	Unclassified Sys/Net/DB Admin Station, Classified DB Admin Station, and Classified Sys/Net Admin Station.
1d	Ultra Enterprise 450 P/N E450	4	Classified and Unclassified Archive/Database Servers, Diskloop Server, and one Pipeline Processor.
1e	Ultra 10 Workstation P/N Ultra 10	13	SOM and Analyst/Evaluator Workstations.
1f	SPARCstation 10 P/N SS10	1	DNS/Mail Server.
1g	E4000 Server Base Unit P/N 600-4583-02	2	Waveform Server and Pipeline Database Server.
1h	StorEdge A3500 P/N SG-ARY391A-364G	1	Data storage for Classified Waveform Server.
1i	External Tape Drive 35-70-DLT 7000 P/N X6060A	2	Provides additional seismic data storage and system backups for Pipeline DB Server and Archive/ Database Server, and enables loading of application software.
1j	SPARCstorage Multipack P/N 595-4280-02	6	External SCSI disk storage for the Waveform Server, Pipeline DB Server, and DNS/Mail Server.
1k	SPARCstorage Multipack2 P/N 595-4451	2	External SCSI disk storage for the Pipeline Database Server.
1l	External 8 mm Tape Drive P/N 595-4846-01	2	Provides additional data storage for Unclassified Sys/Net/DB Admin and Classified Sys/Net Admin Stations.

Table 1-1. Equipment Supplied (Cont)

ITEM	DESCRIPTION	QTY	APPLICATION
1m	StorEdge L3500 P/N 595-4445	1	Data storage for Unclassified Archive Tape Library.
1n	StorEdge L280 P/N L280	1	Data storage for Classified Archive/ Database Server.
1o	20 in Color Monitor P/N 365-1335	3	Provide visual display of system screens and reports.
1p	21 in Color Monitor P/N 365-1383	31	Provide visual display of system screens and reports.
1q	BW Laser Printer, Lexmark P/N OPTRA S 1625	2	Provide print capability for analysts and evaluators.
1r	Console Switch, 12-port P/N KV5012FA	2	Allows monitoring of headless unclassified and classified processors.
1s	16 in Color Monitor P/N 365-1020	2	Connected to Console Switches to provide visual display for headless processors.
2	SOFTWARE		
2a	Solaris Version 2.6 P/N 411-1630-01	Each SUN Machine	Operating system software for each station.
2b	ISIS Version 3.3.1 P/N D007, Rev. 00A	1	COTS software for message distribution and interprocess communication.
2c	SAM-FS Version 3.3.1-36	2	COTS software for data archiving.
2d	Oracle Server Version 7.3.4.5	1 Site License	COTS software for database management and administration.
2e	ArcView Version 3.2 P/N 84319	1	COTS software to interface with Geographic Information System data; provides an interface to the Knowledge Base geographic data.
2f	ArcView Spatial Analysis Version 3.2.31 P/N 75029	1	COTS software for spatial orientation of each image within ArcView.

Table 1-1. Equipment Supplied (Cont)

ITEM	DESCRIPTION	QTY	APPLICATION
2g	FrameMaker Version 5.5.3 P/N 37900226	4	COTS software providing desktop publishing.
2h	Splus Version 5.1	1	COTS software for producing graphics for Perf Mon.
2i	ghostscript Version 2.6.2 Internet download	1	Open Source software for processing PostScript images.
2j	GNU GZIP Version 1.2.4 Internet download	1	Open Source software providing a suite of tools to compress Oracle database.
2k	PERL Version 5.004 Internet download	1	Open Source software for script development.

Table 1-2. Equipment Required but not Supplied

ITEM	DESCRIPTION	QTY	ESSENTIAL CHARACTERISTICS
1	Standard ESD Equipment	1	Used to support ESD precautions for maintenance actions.
2	Cable Repair Kit	1	Suitable for RS-232 cable, twisted pair.
3	RS-232 Breakout Test Tool	1	Used to verify the presence of signals at RS-232 connections.
4	ASCII Terminal (similar to WY-60)	1	Used to view diagnostic data for system machines.
5	DRAM Insertion Tool	1	Used for insertion of DSIMMs in memory slots on SPARCstation 10.
6	DSIMM Extraction Tool	1	Used to extract DSIMMs from memory slots on SPARCstation 10.
7	Calibrated Torque Screwdriver (6 ft-lbs)	1	Used for installation of CPU modules.

Table 1-2. Equipment Required but not Supplied (Cont)

ITEM	DESCRIPTION	QTY	ESSENTIAL CHARACTERISTICS
8	Multimeter, Fluke 75/77 (or equivalent)	1	Portable digital/analog multimeter. Function — Range/Accuracy dc V — 0.1 mV - 1000 V/0.3% ac V — 1 mV - 750 V/2.0% ohms — 0.1 ohms - 32 M ohms/0.5% dc A — .01 mA - 10 A/0.3% ac A — .01 mA - 10 A/0.3%
9	Oscilloscope, Tektronix 222 (or equivalent)	1	Portable, dual vertical channel, digital storage oscilloscope. Function — Range/Sensitivity Operating time: Minimum 2 hours with full charge Charge time: 3 hours Frequency: dc to 10 MHz Digitizing rate: 10 samples/sec Bandwidth: (repetitive) 10 MHz (non-repetitive) 1 MHz Sensitivity: (vertical) 5 mV to 50 V/div (horizontal) 50 ns to 20 sec/div
10	RS-232 Cable	2	DB25 to DB25 connectors.
11	Null-modem adapter	2	DB25 to DB9 connectors.
12	Gender Mender	2	DB25M to DB25M connectors.
13	Gender Mender	2	DB25F to DB25F connectors.
14	Extraction Tool	1	For removal of DIP/ICs.
15	Allen Wrench	1	Standard tool.
16	Screwdriver, Slotted 3/16”	1	Standard tool.
17	Screwdriver, Phillips #0	1	Standard tool.
18	Screwdriver, Phillips #1	1	Standard tool.

Table 1-2. Equipment Required but not Supplied (Cont)

ITEM	DESCRIPTION	QTY	ESSENTIAL CHARACTERISTICS
19	Screwdriver, Phillips #2	1	Standard tool.
20	Hex Driver, M-4	1	Standard tool.
21	Hex Driver, 3/16 in or 5mm	1	Standard tool.
22	Hex Driver, 3/8 in	1	Standard tool.
23	Wrist Strap	1	Electrostatic grounding.
24	Wrench, 13 mm	1	Standard tool.
25	Wrench, 32 mm	1	Standard tool.
26	Wrench, 8 in, adjustable	1	Standard tool.
27	Needle-nose Pliers	1	Standard tool.
28	Flashlight	1	Standard item.

Table 1-3. Leading Particulars

ITEM	DESCRIPTION	CHARACTERISTICS
1	**PHYSICAL CHARACTERISTICS**	
	Weight	5973 lbs
2	**POWER REQUIREMENTS***	
	Voltage	115/230 Vac, 60 Hz
	Current	308.7 A
	Power	26.2 kW
3	**ENVIRONMENTAL CHARACTERISTICS**	
	Temperature (operating) (storage)	50° to 95° F 32° to 122° F

Table 1-3. Leading Particulars (Cont)

ITEM	DESCRIPTION		CHARACTERISTICS
	Relative Humidity (all equipment except Ultra 5 and Ultra 10)	(operating) (storage)	20 to 80% relative (non-condensing) 15 to 95% relative
	Relative Humidity (Ultra 5 and Ultra 10 ONLY)	(operating) (storage)	40 to 80% relative (non-condensing) 30 to 90% relative
	Altitude	(operating) (storage)	0 - 7,000 ft. 0 - 39,700 ft.

*Estimate based on manufacturer-furnished data and engineering estimates for components of the system. Current and power estimates assume that all equipment is operating at surge.

Table 1-4. Capabilities and Limitations

DESCRIPTION	CHARACTERISTICS
Seismic data acquisition	ADSN Data Inputs: SP = 154 LP = 129 BB = 30 ASN Data Inputs: SP = 8 LP = 24 BB = 24 UCSD Data Inputs: BB = 6 USGS Data Inputs (alphanumeric): BB = 9 IDC Data Inputs: SP = 109 LP = 21 BB = 34 MP = 7 EP = 4

Table 1-4. Capabilities and Limitations (Cont)

DESCRIPTION	CHARACTERISTICS
Seismic data acquisition (cont)	SMU Data Inputs: SP = 29 LP = 3 BB =15 CMR Data Inputs: SP = 25 LP = 6 BB = 8 MP = 5 PDAR (Pinedale, Wyoming) SP = 16 BB = 3 06X SP = 31 LP = 9 NORSAR SP = 40 LP = 3 BB = 18
Hydroacoustic data acquisition*	Classified Data Inputs: EP = 18 Unclassified Data Inputs: EP = 12
Infrasonic data acquisition	SP = 15 MP = 7
Data pre-processing	Pre-processing minimizes errors caused by spikes, dropouts and glitches, and allows the user to adjust the error rate threshold. The user is notified if the error rate exceeds the threshold.

Table 1-4. Capabilities and Limitations (Cont)

DESCRIPTION	CHARACTERISTICS
Signal Detection	Performs automatic signal detection and each detection record includes a station identifier, channel or beam information, arrival time, azimuth, maximum peak-to-peak signal amplitude, slowness, fk quality, dominant period, and signal type. A parallel process selects arrival phases from the incoming hydroacoustic data stream. US NDC pre-processes unprocessed data prior to signal detection. Pre-processed data includes pre-filtering data prior to beamforming; configuration of beam parameters, recipe files, and filters; and permits conditioning of the waveform to include removal of system transfer function. The US NDC forms radial and transverse beams for three-component data. The US NDC automatically forms beams from array data and runs detection algorithms over seismic and hydroacoustic waveform data.
Event formation automatic processes	Performs the following automatic processes: phase identification, detection association, geo-location of events; and calculates raw, maximum likelihood, and corrected event magnitudes, when an event is created or changed.

Table 1-4. Capabilities and Limitations (Cont)

DESCRIPTION	CHARACTERISTICS
Interactive data review	Provides interactive tools for review and analysis of seismic data. Interactive windows allow the user to review status, input, and output handling of automatic functions. Provides interactive graphics and display functions for waveforms, beams, maps, fk and spectra. Allows editing phase identification of a detection. An interactive editor permits the association and disassociation of detections to an event, and edits detections or creates new detections. An automatic prediction routine with user-definable parameters predicts arrival times of phases associated with a given event not detected by the automatic signal detection algorithms. Allows manual creation and editing of any event record. Interactive editor allows modification of event locations. Allows manual exclusion of associated detection when determining event location. Provides interactive tool for magnitude calculations. Classifies each event formed as an earthquake or explosion.
Reporting (upon user request)	Generates alert, special, and final event reports. Generates an event bulletin for a given time frame. The US NDC has the capability to process 30,000 events per year within 1-24 hours of occurrence.
Data compression	Compresses waveform data stored on off-line media.
Power and conditioning	Capable of operating on local generator power in the event of an UPS failure.
System capacity	Under normal loading, the US NDC processes up to 100 seismic events per 24 hour work day and at least one event per day for hydroacoustic-only events. Under swarm loading, the US NDC processes up to 400 seismic events per day without disruption or shutdown of the processing system.

Table 1-4. Capabilities and Limitations (Cont)

DESCRIPTION	CHARACTERISTICS
Waveform processing system modes	The US NDC processes data in Global Processing Mode (GPM), Look-Forward, Look-Back/Recall and Spotlight modes of operation. The GPM is the core of the operational system. It covers processing of all waveform data from data acquisition to reporting. Under Look-Forward mode processing, the US NDC is capable of processing one selected area at any given time. Selected unprocessed data is available to the analyst within 60 seconds of arrival at the Classified DAS, and Look-Forward results are available for initial reporting purposes within 10 minutes of data being available. The US NDC allows limited duration tip-off processing of selected IMS stations. Under the Look-Back/Recall mode, the US NDC capability allows additional processing on one limited geographical area and time interval, in order to perform more thorough processing than previously obtained, whenever outside information indicates a possible nuclear explosion has occurred. Separate database accounts and disk space are provided for a maximum of six two-week data sets of GPM station network. Look-Back processing results are available immediately to the analyst. Under the Spotlight mode, the US NDC provides continuous routine monitoring of two high-concern areas at lower thresholds than standard network processing. The US NDC Spotlight processing can be customized to meet varying requirements of each region.

Table 1-4. Capabilities and Limitations (Cont)

DESCRIPTION	CHARACTERISTICS
Late arriving data	The US NDC notifies the SOM of late arriving data. Data is sent through automatic processing and incorporated into regularly scheduled products so as to be available to analyst within five minutes of receipt by the Classified System.
Derived date waveform beam availability	The US NDC provides beam parameters on-line for a minimum of 30 days.
Event location	The US NDC computes an origin using available seismic waveform data and defines location by latitude, longitude, depth (elevation), origin time, and earth model. Three solutions are computed for any selected seismic event location (e.g., depth unconstrained, depth fixed at the Earth's surface, and depth restrained to a user-specified value).
Interactive analysis capability	The US NDC interactive analysis provides the capability for a user to review, refine, correct, and/or display the currently available results generated from automated processing systems or from previous analysis by another user.
Data storage and access	The US NDC stores all unprocessed waveform data received by class. Classes are based on the age of data; data classes may overlap
(1) UDAS storage classes	• Short-term: all data less than 7 days old is accessible in 5 seconds. • Intermediate: data between 7 and 10 days old is accessible in 30 minutes. • Long-term DLT archive library: data between 10 and 180 days old is accessible within 60 minutes. All unprocessed waveform data will be archived for a minimum of 180 days.

Table 1-4. Capabilities and Limitations (Cont)

DESCRIPTION	CHARACTERISTICS
(2) CDAS storage classes and archives	• Short-term: all data less than 45 days old is accessible in 5 seconds. • Long-term alphanumeric data: all data greater than 45 days is accessible in 24 hours.
Data Management Services (DMS)	Data removed from on-line storage can be restored within 24 hours.
Identification and Authentication	The US NDC provides user ID password controls. Individual accountability is enforced by providing capability to uniquely identify each user. Password files are protected from unauthorized users.

*Maximum capability is dependent upon available storage of data acquisition system.

Table 1-5. Related Publications

PUBLICATION NUMBER	PUBLICATION NAME
2SE-SWITCH/KV5200-1	ServSwitch Ultra Installation and Operation Manual (KV5200 Series)
2WS-8MMTD/DSM-1	Installation and User's Manual, 14 GByte, 8mm Tape Desktop Storage Pack (802-1638-10, Rev. A)
2WS-DA/D1000-8	Sun StorEdge D1000 Storage Guide (805-4013-10)
2WS-DA/X1000-1	Sun StorEdge A1000 and D1000 Installation, Operations, and Service Manual (805-2624-10)
2WS-DA/X1000-11	Sun StorEdge RAID Manager 6.22 A1000 and D1000 Product Note (805-4866-10)
2WS-DLT/L280-1	Sun StorEdge L280 User's Guide (805-3957-11)
2WS-DLT/L3500-1	Sun StorEdge L3500 Operator's Guide (805-1035-11)
2WS-PRNTR/NA-7	Lexmark Printer Network Adapter Hardware Setup (16A0120)
2WS-PRNTR/OPTRAS-1	Lexmark Printer Optra S User's Guide (43H5318)
2WS-RAID/6.22-1	Sun StorEdge RAID Manager 6.22 User's Guide (806-0478-10)

Table 1-5. Related Publications (Cont)

PUBLICATION NUMBER	PUBLICATION NAME
2WS-RAID/6.22-11	Sun StorEdge RAID Manager 6.22 Release Notes (805-7758-11)
2WS-RAID/6.22-7	Sun StorEdge RAID Manager 6.22 Installation and Support Guide for Solaris (805-7756-10)
2WS-RAID/A3500-1	Sun StorEdge A3500/A3500FC Hardware Configuration Guide (805-4981-13)
2WS-RAID/A3500/CM-1	Sun StorEdge A3500/A3500FC Controller Module Guide (805-4980-11)
2WS-SAM-FS-8	SAM-FS System Administrator's Guide
2WS-SPARC/DLT7000-1	Sun 35-70 GByte SPARCstorage DLT 7000 Manual (805-0648-10)
2WS-SPARC/MP-1	Sun SPARCstorage MultiPack User's Guide (802-4428)
2WS-SPARC/MP-7	Sun SPARCstorage MultiPack Installation (802-4429)
2WS-SPARC/MP2-2	Sun SPARCstorage MultiPack 2 Service Manual (805-1667)
2WS-SPARC10-1	Sun SPARCstation 10 Service Manual (800-6358)
2WS-SUN/CM/17/20-1	17-inch/20-inch Premium Color Monitor Guide
2WS-SUN/CM/21-1	21-inch Premium Color Monitor Guide
2WS-SUN/KB5-11	Sun Type 5c Keyboard and Mouse Product Notes
2WS-ULTRA/E4000-1	Sun Ultra Enterprise 6000/5000/4000 Systems Manual (802-3845)
2WS-ULTRA/E450-1	Ultra Enterprise 450 Server Owner's Guide (805-0429-10, Rev. A)
2WS-ULTRA1-2	Sun Ultra 1 Creator Series Service Manual (802-4148)
2WS-ULTRA5/10-2	Sun Ultra 5/10 Service Manual (805-0423)

CHAPTER 2

INSTALLATION

2-1. INTRODUCTION.

2-2. For installation and start-up procedures, refer to chapter 2 of TI 2-NDC-2.

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CHAPTER 3

OPERATION

3-1. INTRODUCTION.

3-2. Chapter 3 is divided into three sections according to function. Each section provides a detailed description of the primary software controls and indicators, and complete operating instructions (OI) for the corresponding function.

SECTION I

DATA ACQUISITION MANAGER

3-3. GENERAL.

3-4. The Data Acquisition Manager (DAM) provides monitoring and control of the seismic and hydroacoustic data received into the United States National Data Center (US NDC) to ensure the continuous acquisition and processing of the data. There are two DAM stations; one each for the Unclassified and Classified Systems. As data flows into the Unclassified System, the operator can utilize a variety of tools on the unclassified DAM to review the status and log files associated with the unclassified data acquisition processes. These processes receive the data, archive the data, and forward the data to the Classified System. The data may also be forwarded to the International Data Centre (IDC) and other external recipients. The comparison of the data acquired by the US NDC and the data forwarded to the IDC may also be displayed by the user to ensure that all data forwarded to the IDC by the US NDC is received.

3-5. The same suite of tools is also available on the classified DAM. The classified DAM operator can use these tools to review the status and log files associated with the processes involved with the acquisition of the data forwarded from the Unclassified System to the Classified System and all data received by external classified sources. Data is archived on the Classified System, with tools available to monitor and control this archiving process. A graphical display is available to compare the data acquired by the Classified System with the data acquired by the Unclassified System. Again, this ensures that all the data forwarded by the Unclassified System is received by the Classified System.

3-6. This section provides procedures for controlling and monitoring the US NDC data acquisition using the DAM functions on both the Classified and Unclassified Systems. Included is a brief description of the functions performed by the DAM, a description of the interfaces available to perform the activities, and detailed steps to perform the procedures.

3-7. CONTROLS AND INDICATORS.

3-8. The DAM functions can be performed on any station which is configured for that use. After logging on, the operator is presented with the Common Desktop Environment (CDE). The initial appearance of the desktop is shown in figure 3-1. The main graphical user interface (GUI) tools used by the DAM are Launch and WorkFlow.

3-9. The CDE is divided into four operator assignable work areas; Acquisition, Archive, Mail, and Launch are shown. Operator access to each of these work areas is achieved by left-clicking on the required button in the CDE.

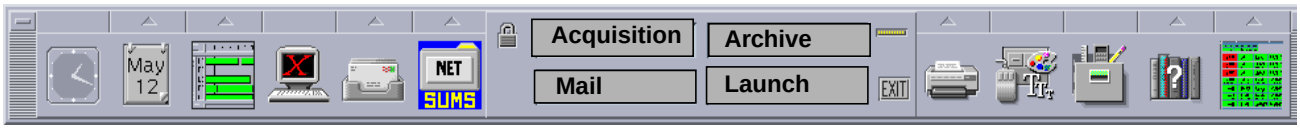

Figure 3-1. CDE Toolbar

3-10. UNCLASSIFIED DATA ACQUISITION LAUNCH.

3-11. The Unclassified Data Acquisition Launch GUI (figure 3-2) provides the operator with the ability to start and stop key processes, determine the status of processing machines, and determine the status of individual processes involved in acquiring and storing the data in the Unclassified System.

3-12. The application menu bar at the top of the Unclassified Data Acquisition Launch GUI provides the menu buttons **File** and **View**:

a. The **File** menu provides one selection: **Exit**. Used to quit Unclassified Data Acquisition Launch GUI.

b. The **View** menu provides two selections that are used in conjunction with the scrolling text area seen at the bottom of the Unclassified Data Acquisition Launch GUI:

(1) **Clear**. Removes all messages from the message area.

(2) **Print**. Prints the messages in the message area.

Figure 3-2. Unclassified Data Acquisition Launch GUI

3-13. The Unclassified Data Acquisition Launch GUI contains the status block for the process host (upper area with small blocks) and processes (lower area with large blocks). Status of the blocks is indicated by colors and text in the buttons:

a. green = running

b. red = stopped

c. blue = idle

d. burgundy (host) = running/read only

e. burgundy (process) = unknown

3-14. Right-clicking on any status block brings up a menu of actions for that block.

3-15. The host button provides the following selections:

a. **Load**. Starts an xload window for that host.

b. **Login**. Brings up an xterm window for that host.

c. **Start Launchd**. Starts the Launchd_sockd process.

d. **Stop Launchd**. Stops the Launchd_sockd process.

e. **Start Process Check Cron**. Insert the ProcessCheck cron job entry to be inserted into the OPS crontab.

f. **Stop Process Check Cron.** Remove the ProcessCheck cron job entry from the OPS crontab.

g. **Start AsciiWorkflow Cron.** Insert the AsciiWorkflow cron entry into the OPS crontab.

h. **Stop AsciiWorkflow Cron**. Remove the AsciiWorkflow cron entry from the OPS crontab.

i. **Start NdcIdcStats**. Insert the NdcIdcStats cron entry into the OPS crontab.

j. **Stop NdcIdcStats**. Remove the NdcIdcStats cron entry from the OPS crontab.

3-16. The process buttons provide the following selections:

a. **Start**. Start the selected process.

b. **Stop**. Stops the selected process in an orderly manner (preferred).

c. **Kill**. Kills the selected process instantly (may result in loss of data).

d. **Details**. Brings up a window showing the equivalent of a ps command for the process.

e. **Monitor**. Lists the most recent 19 lines of the process log in a new xterm window that scrolls as new lines are added to the log.

3-17. UNCLASSIFIED DATA ACQUISITION CRON LAUNCH.

3-18. The Unclassified Data Acquisition Cron Launch GUI (figure 3-3) provides the operator with the ability to start and stop key processes and to determine the status of processing machines and processes involved in acquiring data.

3-19. The application menu bar at the top of the Unclassified Data Acquisition Cron Launch GUI provides the menu buttons **File** and **View**:

a. The **File** menu displays one selection: **Exit**. Used to quit Launch.

b. The **View** menu provides two selections that are used in conjunction with the scrolling text area seen at the bottom of GUI:

(1) **Clear**. Removes all messages from the message area.

(2) **Print**. Prints the messages in the message area.

3-20. The Unclassified Data Acquisition Cron Launch GUI contains status blocks for the process host (upper area with small blocks) and processes (lower area with large blocks). Status of the blocks is indicated by colors and text in the buttons:

a. green = running

b. red = stopped

c. blue = idle

d. burgundy (host) = running/read only

e. burgundy (process) = unknown

3-21. Right-clicking on any status block brings up a menu of actions for that block.

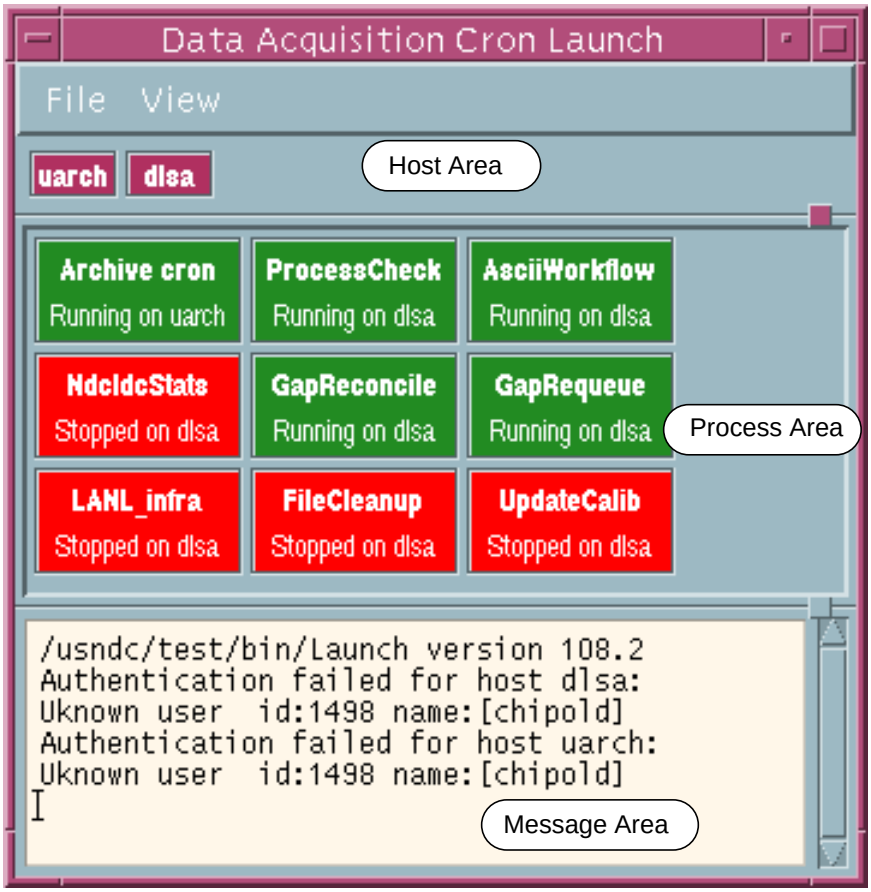

Figure 3-3. Unclassified Data Acquisition Cron Launch GUI

3-22. The host buttons provide the following menu selections:

a. **Load**. Starts an xload window for that host.

b. **Login**. Brings up an xterm window for that host.

c. **Start Launchd**. Starts the Launchd_sockd process.

d. **Stop Launchd**. Stops the Launch_sockd process.

3-23. The process buttons provide the following selections:

a. **Start**. Installs the cron entries into operation.

b. **Stop**. Removes the cron entries from operation.

c. **LIst**. Displays the cron entries themselves.

3-24. UNCLASSIFIED FORWARD LAUNCH.

3-25. The Unclassified Forward Launch GUI provides the operator with the ability to start and stop key processes, to determine the status of processing machines, and individual processes involved in forwarding data from the Unclassified System to an external testbed. The Unclassified Forward Launch GUI is shown in figure 3-4.

3-26. The application menu bar at the top of the Unclassified Forward Launch GUI provides the menu buttons **File** and **View**:

a. The **File** menu provides one selection. **Exit** is used to quit Unclassified Forward Launch GUI.

b. The **View** menu provides two selections that are used in conjunction with the scrolling text area seen at the bottom of the Launch GUI:

(1) **Clear**. Removes all messages from the message area.

(2) **Print**. Prints the messages in the message area.

3-27. The Unclassified Forward Launch GUI contains the status block for the process host (upper area with small blocks) and processes (lower area with large blocks). Status on the blocks is shown visually by colors and status text in the buttons:

a. green = running

b. red = stopped

c. blue = idle

d. burgundy (host) = running/read only

e. burgundy (process) = unknown

3-28. Right-clicking on any block brings up a menu of actions for that block.

3-29. The host button provides the following selections:

a. **Load**. Starts an xload window for the host.

b. **Login**. Brings up an xterm window for the host.

3-30. The process buttons provide the following selections:

a. **Start**. Start the selected process.

b. **Stop**. Stops the selected process in an orderly manner (preferred).

c. **Kill**. Kills the selected process instantly (may result in loss of data).

d. **Details**. Brings up a window showing the equivalent of a ps command for the process.

e. **Monitor**. Lists the most recent 19 lines of the process log in a new xterm window that scrolls as new lines are added to the log.

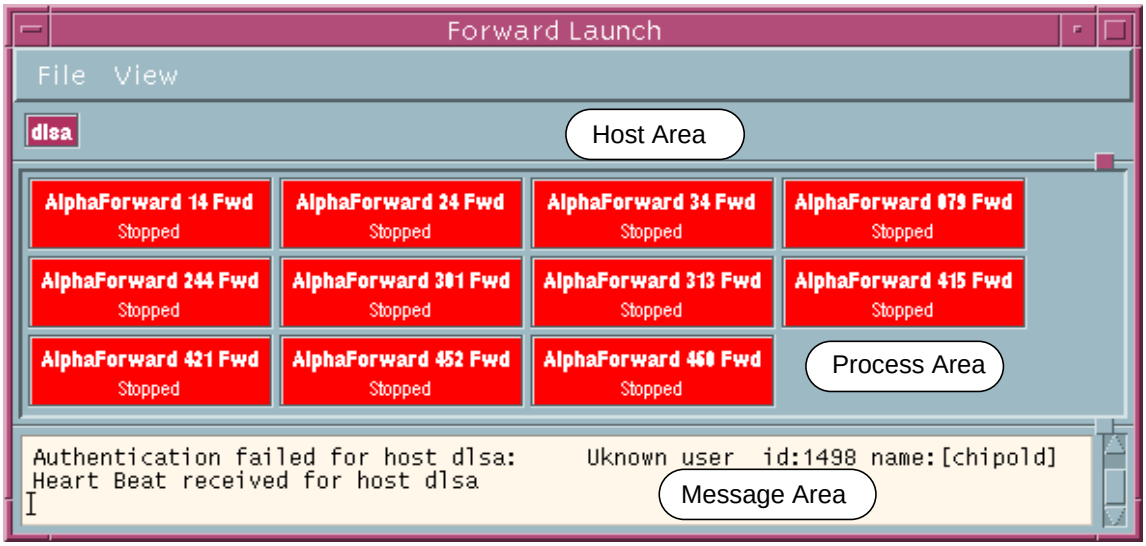

Figure 3-4. Unclassified Forward Launch GUI

3-31. UNCLASSIFIED GAP LAUNCH.

3-32. The Unclassified Gap Launch GUI provides the operator with the ability to start a utility which allows the operator to interactively request gaps from the AFTAC Distributed Subsurface Network (ADSN) (Request ADSN Gap) and to start and stop file2alpha processes associated with gap handling. The file2alpha processes are only utilized during the retrieval of gaps; therefore, the processes for the requested stations can be turned on before retrieving a gap, and turned off after the data has been received. The Unclassified Gap Launch GUI is shown in figure 3-5.

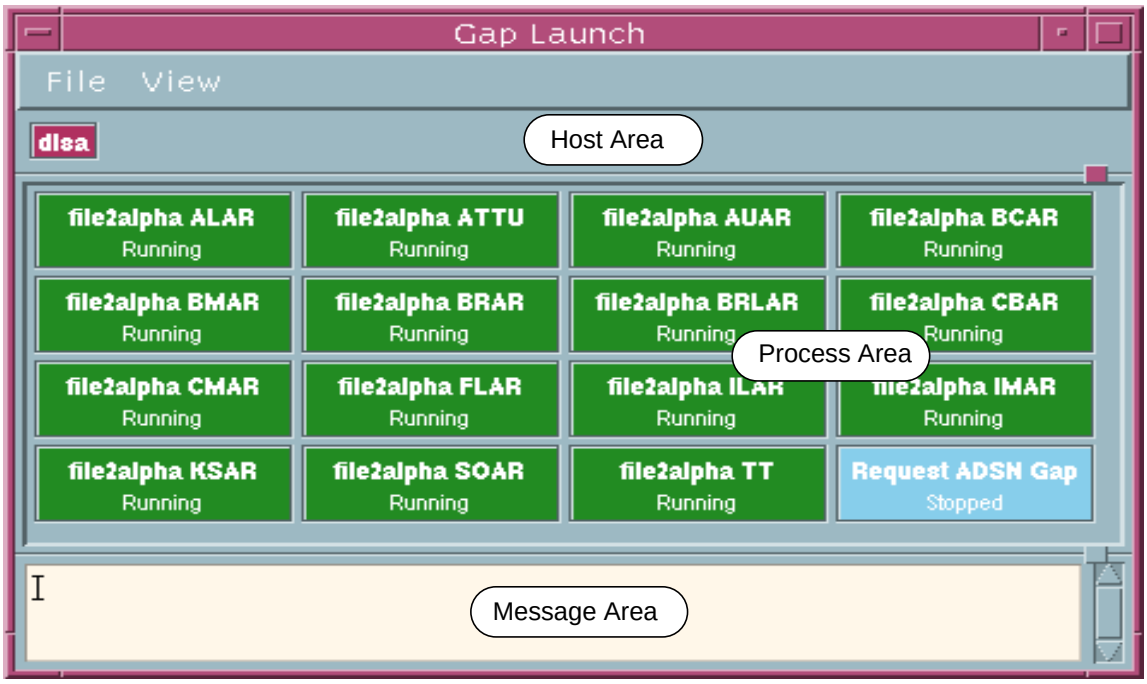

Figure 3-5. Unclassified Gap Launch GUI

3-33. The application menu bar at the top of the Unclassified Gap Launch GUI provides the menu buttons **File** and **View**:

a. The **File** menu provides one selection: **Exit**. Used to quit Unclassified Gap Launch GUI.

b. The **View** menu provides two selections which are used in conjunction with the scrolling text area seen at the bottom of the Unclassified Gap Launch GUI:

(1) **Clear**. Removes all messages from the message area.

(2) **Print**. Prints the messages in the message area.

3-34. Right-clicking on any status block brings up a menu of actions for that block.

3-35. The host buttons provide the following selections:

a. **Load**. Starts an xload window for that host.

b. **Login**. Brings up an xterm window for that host.

c. **Start Launchd**. Starts the Launchd_sockd process.

d. **Stop**. Stops the Launchd_sockd process.

3-36. The process buttons provide the following selections:

a. **Start**. Start the selected process.

b. **Stop**. Stops the selected process in an orderly manner (preferred).

c. **Kill**. Kills the selected process instantly (may result in loss of data).

d. **Details**. Brings up a window showing the equivalent of a ps command for the process.

e. **Monitor**. Lists the most recent 19 lines of the process log in a new xterm window that scrolls as new lines are added to the log.

3-37. UNCLASSIFIED DATA ACQUISITION WORKFLOW.

3-38. The Unclassified Data Acquisition WorkFlow GUI provides the DAM operator with the ability to monitor the state of data acquisition in the Unclassified System. The Unclassified Data Acquisition WorkFlow GUI is shown in figure 3-6. The display consists of several rows of colored bricks, where each brick represents a data object in the system having a unique time interval, processing class, and name. The color of the interval indicates the state of the data processing performed on that interval. In this way, the DAM can keep track of the presence of on-time data or near real-time data.

3-39. The following list describes the uses of the Data Acquisition WorkFlow GUI elements:

a. History scale bar. Selects the lookback limit for intervals. Only intervals more recent than the current time less the history time can be displayed. The current history time is displayed on the duration/history indicator.

b. Duration scale bar. Selects time span of intervals viewable on the display. The current duration is displayed on the duration/history indicator.

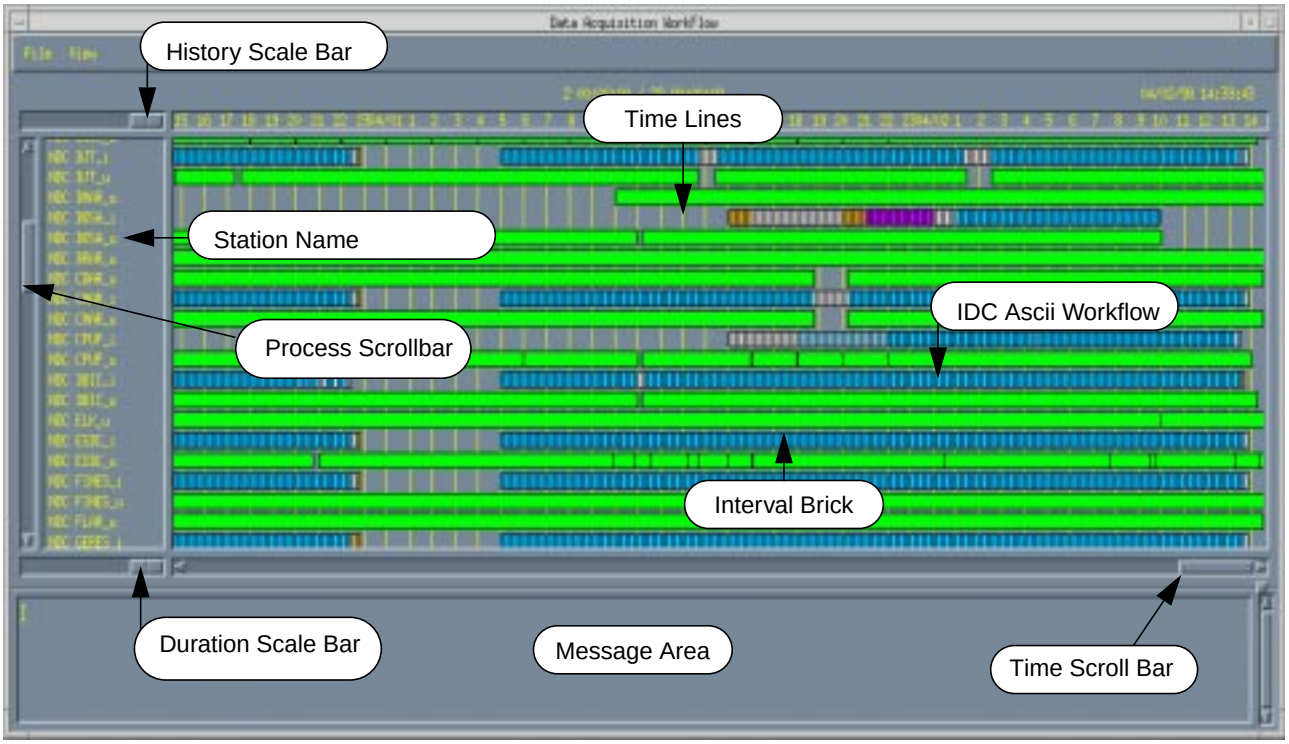

Figure 3-6. Unclassified Data Acquisition WorkFlow GUI

c. Time scroll bar. Scrolls the portion of the history to be displayed. When the slider is all the way to the right of the scroll bar, the current time appears on the right edge of the time lines. Sliding the scroll bar all the way to the left will display the time span starting with the first available data interval.

d. Process scroll bar. Scrolls the intervals to be displayed, if there are too many to show in the pane. The scrolling occurs automatically when the latest intervals are displayed in the window.

e. Message scroll bar. Scrolls the message area, if there are too many messages in the pane.

3-40. The application menu bar, at the top of the Data Acquisition WorkFlow GUI, provides the menu buttons **File** and **View**:

a. The **File** menu provides one selection: **Exit**. Used to quit WorkFlow.

b. The **View** menu provides six selections, two of which are used in conjunction with the scrolling text area seen at the bottom of the WorkFlow window:

(1) **Update**. Updates the window immediately instead of waiting for the normal periodic update.

(2) **Reset**. Rereads all information into WorkFlow as if the application has just started.

(3) **Clear**. Removes all messages from the message area.

(4) **Print**. Prints the messages in the message area

(5) **Exception**. Not Used.

(6) **State Color Codes**. Brings up a list of color codes and their interpretations for reference.

3-41. The **State Color Codes** popup window selected from the **View** menu is shown in figure 3-7. This window is used as a quick reference to show the set of state colors used in the WorkFlow window.

3-42. Each interval brick in Unclassified Data Acquisition WorkFlow (figure 3-7) has an associated popup window (figure 3-8) that is displayed by right-clicking on the interval. The popup window provides the station name, start time, end time, and classification for the selected interval brick.

Figure 3-7. State Color Codes Popup Window

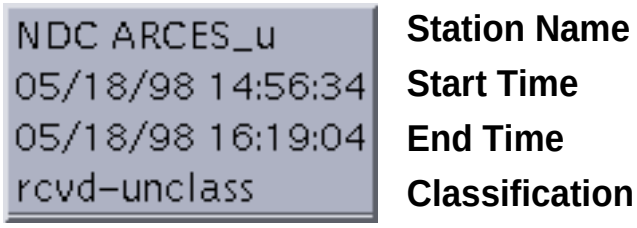

Figure 3-8. Interval Popup Window

3-43. CLASSIFIED DATA ACQUISITION LAUNCH.

3-44. The Classified Data Acquisition Launch GUI (figure 3-9) provides the operator the ability to start and stop key processes, and to determine the status of processing machines and individual processes involved in pipeline processing in the Classified System.

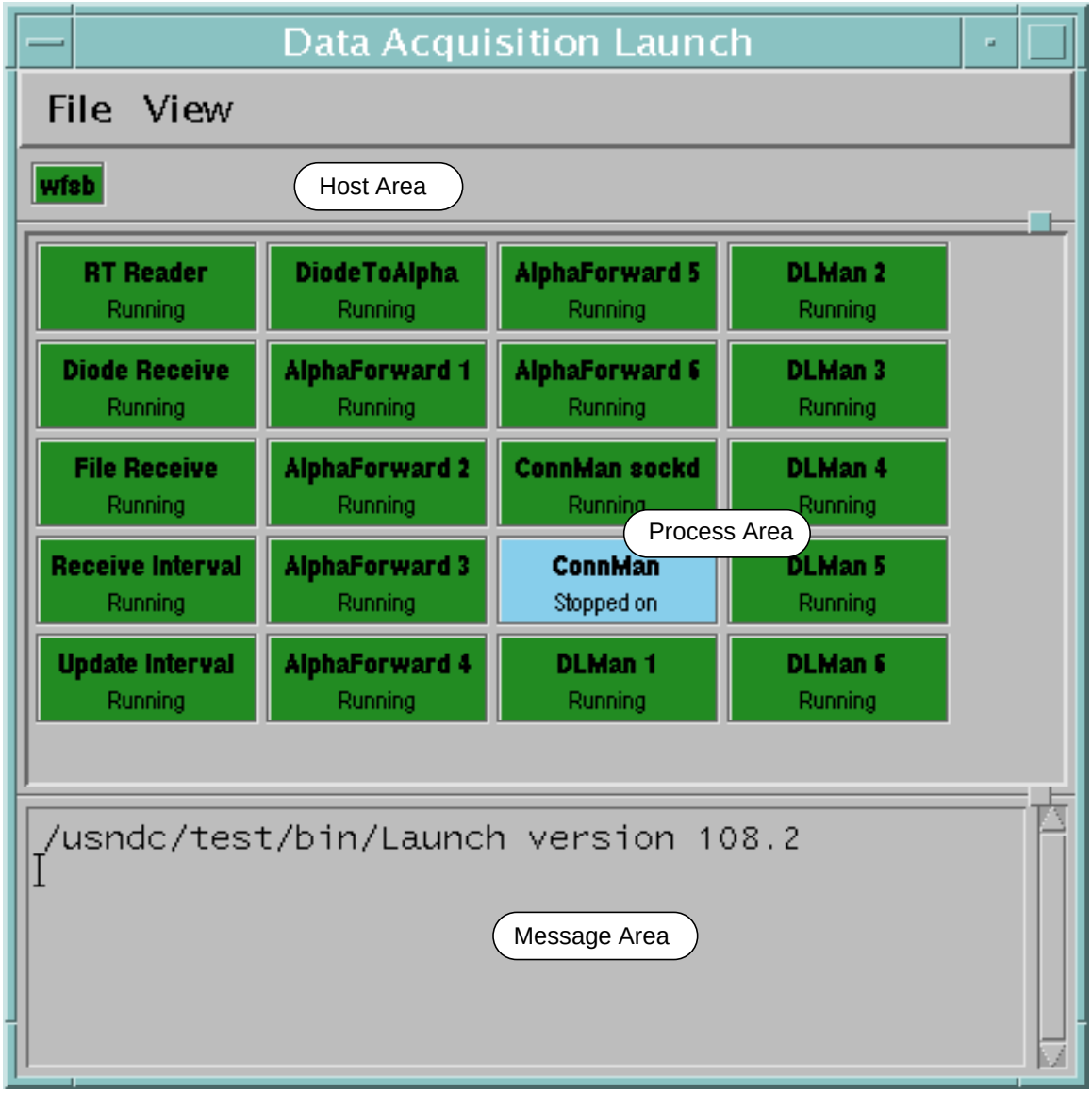

Figure 3-9. Classified Data Acquisition Launch GUI

3-45. The application menu bar at the top of the Classified Data Acquisition Launch GUI provides the menu buttons **File** and **View**:

a. The **File** menu displays one selection: **Exit**. Used to quit Classified Data Acquisition Launch.

b. The **View** menu provides two selections that are used in conjunction with the scrolling text area seen at the bottom of the Launch window:

(1) **Clear.** Removes all messages from the message area.

(2) **Print.** Prints the messages in the message area.

3-46. The Classified Data Acquisition Launch window contains status blocks for the process hosts (upper area with small block) and processes (lower area with large blocks). Status on the blocks is shown visually by colors and status text in the buttons:

a. green = running

b. red = stopped

c. blue = idle

d. burgundy = unknown

e. burgundy (host) = running/read only

f. burgundy (process) = unknown

3-47. Right-clicking on any block brings up a menu of actions for that block, giving options to control or status the process.

3-48. The host button provides the following selections:

a. **Load**. Starts an xload window for that host.

b. **Login**. Brings up an xterm window for that host.

c. **Start Launchd**. Starts the Launchd_sockd process.

d. **Stop Launchd**. Stops the Launchd_sockd process.

3-49. The process buttons provide the following selections:

a. **Start**. Start the selected process.

b. **Stop**. Stops the selected process in an orderly manner (preferred).

c. **Kill**. Kills the selected process instantly (may result in loss of data).

d. **Details**. Brings up a window showing the equivalent of a ps command for the process.

e. **Monitor**. Lists the most recent 19 lines of the process log in a new xterm window that scrolls as new lines are added to the log.

3-50. The processes seen in the Classified Data Acquisition Launch GUI (listed below) are started automatically, but can be started and stopped as needed. Some blocks are blue to indicate that process is only run on an as-needed basis.

a. RT Reader

b. Diode Receive

c. File Receive

d. Receive Interval

e. Update Interval

f. DiodeToAlpha

g. AlphaForward 1-6

h. ConnMan sockd

i. ConnMan

j. DLMan 1-6

3-51. CLASSIFIED DATA ACQUISITION CRON LAUNCH.

3-52. The Classified Data Acquisition Cron Launch GUI (figure 3-10) provides the operator the ability to start and stop key processes, and to determine the status of processing machines and individual processes involved in pipeline processing in the Classified System.

3-53. The application menu bar at the top of the Classified Data Acquisition Cron Launch GUI provides the menu buttons **File** and **View**:

a. The **File** menu displays one selection: **Exit**. Used to quit Classified Data Acquisition Cron Launch.

b. The **View** menu provides two selections that are used in conjunction with the scrolling text area seen at the bottom of the Launch window:

(1) **Clear.** Removes all messages from the message area.

(2) **Print.** Prints the messages in the message area.

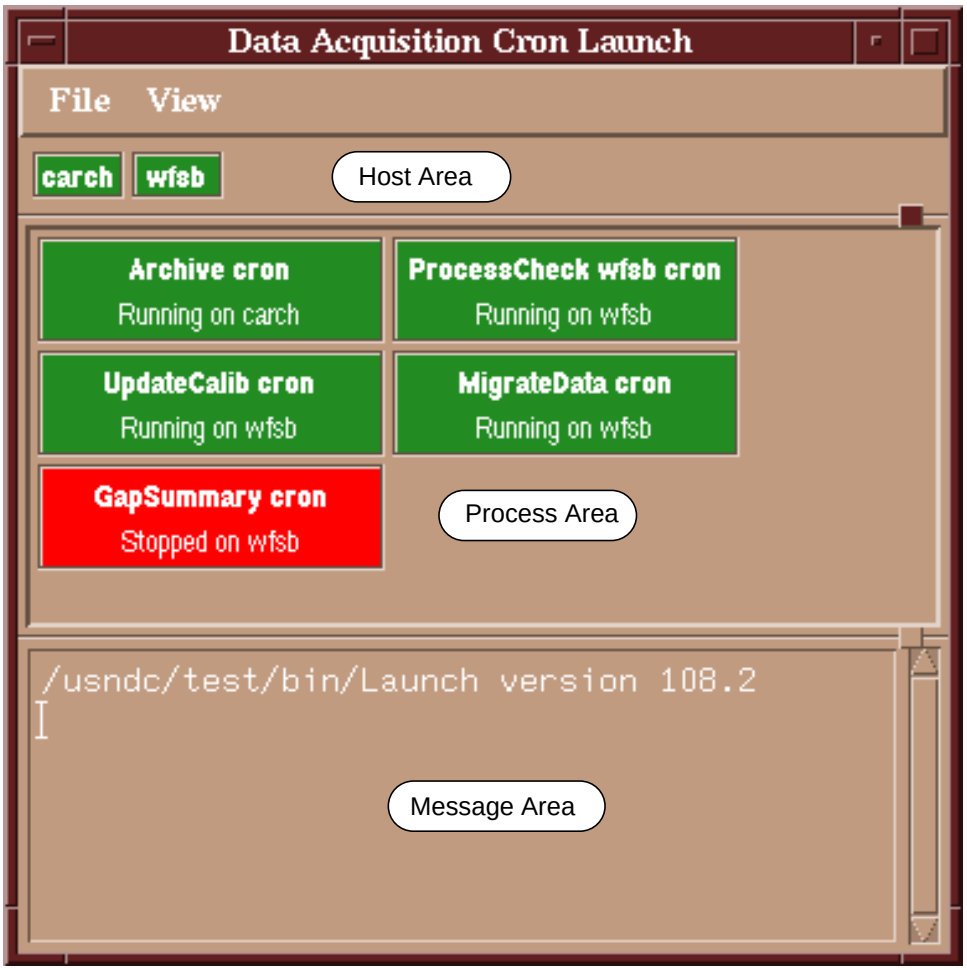

Figure 3-10. Classified Data Acquisition Cron Launch GUI

3-54. The Classified Data Acquisition Cron Launch window contains status blocks for the process hosts (upper area with small block) and processes (lower area with large blocks). Status on the blocks is shown visually by colors and status text in the buttons:

a. green = running

b. red = stopped

c. blue = idle

d. burgundy = unknown

e. burgundy (host) = running/read only

f. burgundy (process) = unknown

3-55. Right-clicking on any block brings up a menu of actions for that block, giving options to control or status the process.

3-56. The host button provides the following selections:

a. **Load**. Starts an xload window for that host.

b. **Login**. Brings up an xterm window for that host.

c. **Start Launchd**. Starts the Launchd_sockd process.

d. **Stop Launchd**. Stops the Launchd_sockd process.

3-57. The process buttons provide the following selections:

a. **Start**. Install the cron entries into operation.

b. **Stop**. Removes the cron entries from operation.

c. **List**. Displays the cron entries themselves.

d. **Details**. Brings up a window showing the equivalent of a ps command for the process.

e. **Monitor**. Lists the most recent 19 lines of the process log in a new xterm window that scrolls as new lines are added to the log.

3-58. The processes seen in the Classified Data Acquisition Cron Launch GUI are started automatically, but can be started and stopped as needed. Some blocks are blue to indicate that process is only run on an as-needed basis.

3-59. CLASSIFIED DATA ACQUISITION WORKFLOW.

3-60. The Classified Data Acquisition WorkFlow GUI provides the operator the ability to monitor the state of the classified data acquisition (figure 3-11).

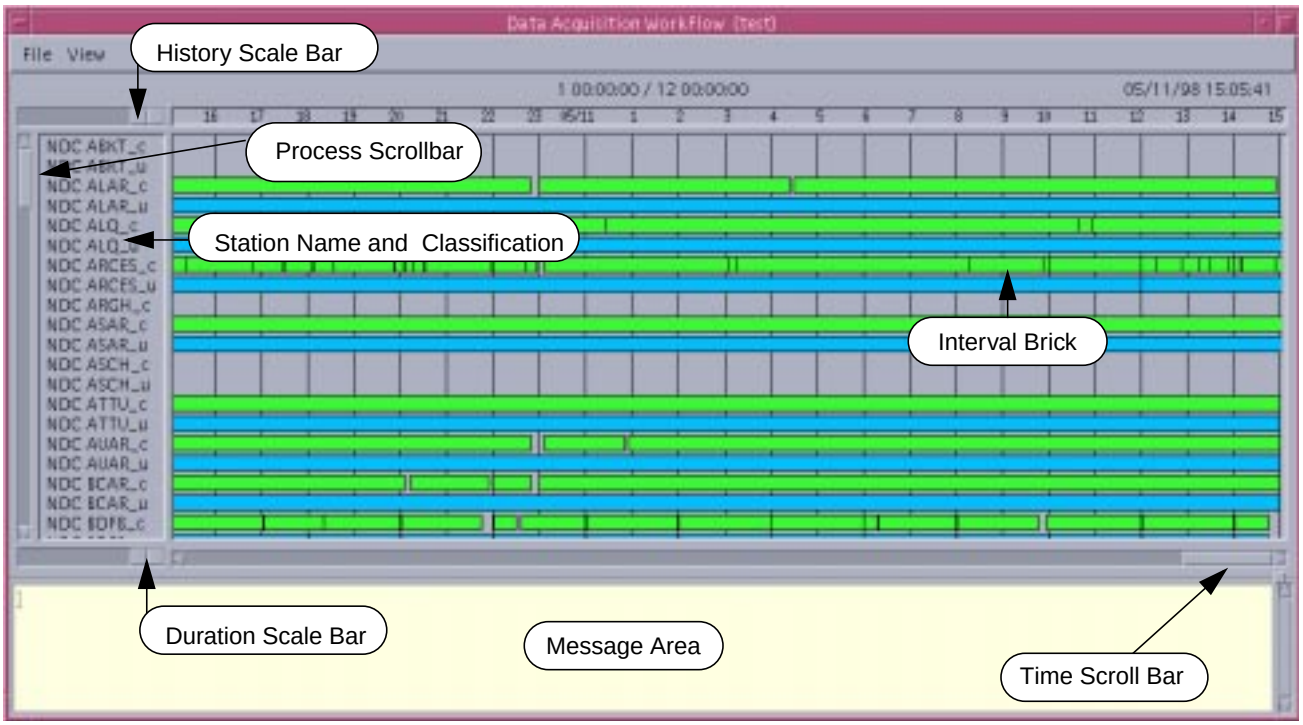

Figure 3-11. Classified Data Acquisition WorkFlow GUI

3-61. The application menu bar at the top of the Classified Data Acquisition WorkFlow GUI provides the menu buttons **File** and **View**:

a. The **File** menu provides one selection: **Exit**. Used to quit the Classified Data Acquisition WorkFlow.

b. The **View** menu provides six selections, two of which are used in conjunction with the scrolling text area seen at the bottom of the Classified Data Acquisition WorkFlow GUI:

(1) **Update**. Updates the window immediately instead of waiting for the normal periodic update.

(2) **Reset**. Rereads all information into WorkFlow as if the application has just started.

(3) **Clear**. Removes all messages from the message area.

(4) **Print**. Prints a hardcopy of the messages in the message area.

(5) **Exception List.** Not used.

(6) **State Color Codes**. Brings up a list of color codes and their interpretations for reference.

3-62. The **State Color Codes** popup window selected from the **View** menu is shown in figure 3-12. This window is used as a quick reference to show the set of state colors used in the WorkFlow window.

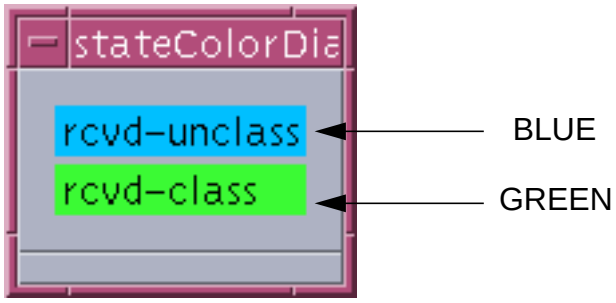

Figure 3-12. State Color Dialog Popup Window

3-63. Each interval brick in Classified Data Acquisition WorkFlow GUI has an associated Interval popup window (figure 3-13) that is displayed by right-clicking on the interval. The popup window provides the station name, start time, end time, and classification for the selected interval brick.

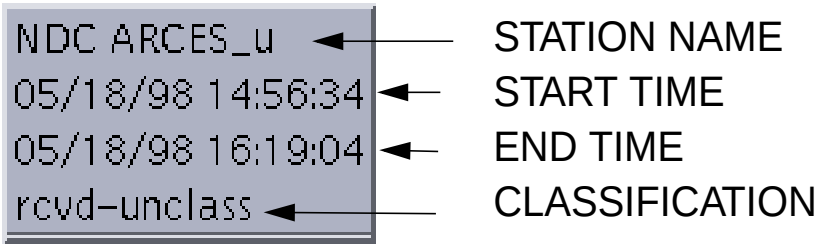

Figure 3-13. Interval Popup Window

3-64. STATION STATUS.

3-65. The station command is provided for operator troubleshooting in the event that one of the station's data is running behind allowable limits. The station command provides a way of looking at the data acquisition status of one or all stations from the connection to the diskloops through forwarding of the data. The options available to the station command are shown in figure 3-14.

```
/usndc/ops/bin/station: Options are:

 station [-f <par_file>] where {all [<net>] | <station>}

 station [-f <par_file>] last  [dl|wf|fw] {all [<net>] | <station>}

 station [-f <par_file>] info {all [<net>] | <station>}
```

Figure 3-14. Station Commands Options

3-66. UNCLASSIFIED ARCHIVE LAUNCH.

3-67. The Unclassified Archive Launch GUI provides the operator the ability to start, stop and monitor the operation of the archive processes ArchiveLongTerm, ArchivePermanent and ArchiveClean. The Unclassified Archive Launch GUI is shown in figure 3-15.

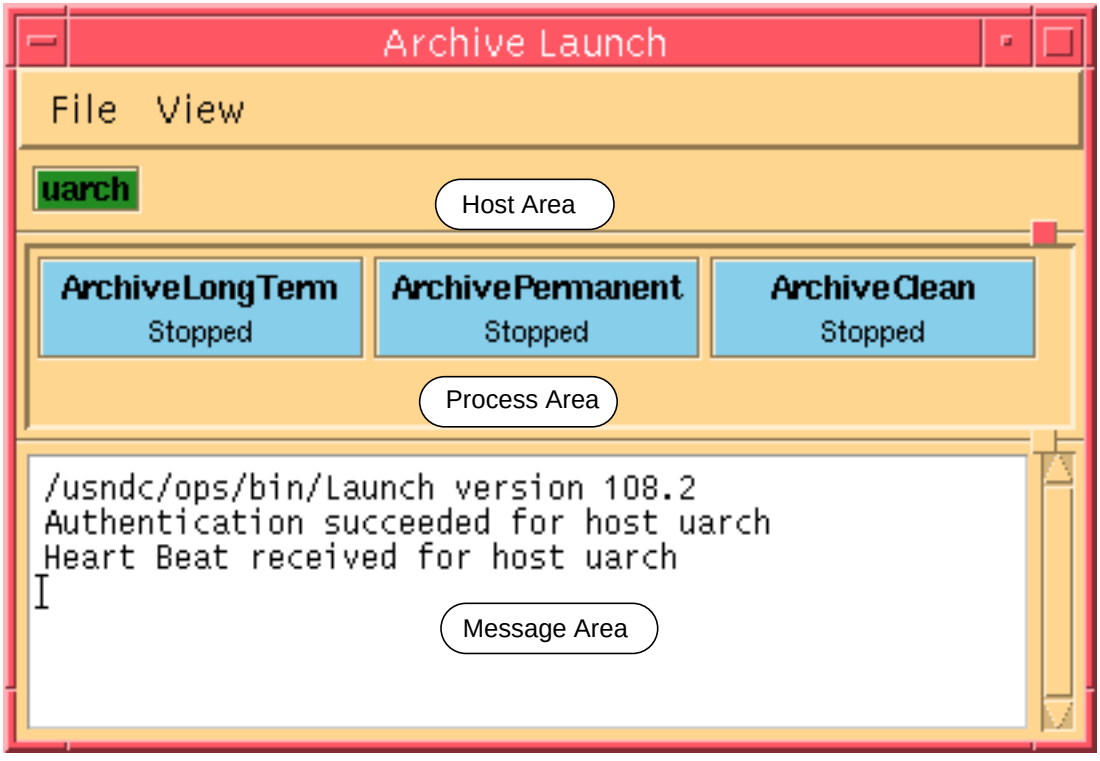

Figure 3-15. Unclassified Archive Launch GUI

3-68. The application menu bar at the top of the Unclassified Archive Launch GUI provides the menu buttons **File** and **View**:

a. The **File** menu provides one selection: **Exit**. Used to quit the Unclassified Archive Launch GUI.

b. The **View** menu provides two selections that are used in conjunction with the scrolling text area seen at the bottom of the Launch window:

(1) **Clear**. Removes all messages from the message area.

(2) **Print**. Prints a hardcopy of the messages in the message area.

3-69. The Unclassified Archive Launch GUI contains status blocks for the process host (upper area with small blocks) and archive processes (lower area with large blocks). Status of the blocks is shown visually by colors and status text in the buttons:

a. green = running

b. red = stopped

c. blue = idle

d. burgundy (host) = running/read only

e. burgundy (process) = unknown

3-70. Right-clicking on any block brings up a menu of actions for that block, giving options to control or status the process.

3-71. The host buttons provide the following selections:

a. **Load.** Starts an xload window for that host.

b. **Login.** Brings up an xterm window for that host.

c. **Start Launchd**. Starts the sockd process on the archive machine.

d. **Stop Launchd**. Stops the sockd process on the archive machine.

3-72. The process buttons provide the following selections:

a. **Start.** Start the selected process.

b. **Stop.** Stops the selected process in an orderly manner (preferred).

c. **Kill**. Kills the selected process instantly (may result in loss of data). Not available on the Archive Cron Process.

d. **Details**. Brings up a window showing the equivalent of a ps command for the process. Not available on the Archive Cron Process.

e. **Monitor**. Lists the most recent 19 lines of the process log in a new xterm window that scrolls as new lines are added to the log. Not available on the Archive Cron Process.

f. **List**. Lists the Cron processes currently running. Available only on the Archive Cron Process button.

3-73. CLASSIFIED ARCHIVE LAUNCH.

3-74. The Classified Archive Launch GUI provides the operator the ability to start, stop and monitor the operation of the archive processes ArchiveLongTerm and ArchivePermanent. The Classified Archive Launch GUI is shown in figure 3-16.

3-75. The application menu bar at the top of the Classified Archive Launch GUI provides the menu buttons **File** and **View**:

a. The **File** menu displays one selection: **Exit**. Used to quit the Classified Archive Launch GUI.

b. The **View** menu provides two selections that are used in conjunction with the scrolling text area seen at the bottom of the Classified Archive Launch GUI:

(1) **Clear.** Removes all messages from the message area.

(2) **Print**. Prints a hardcopy of the messages in the message area.

3-76. The Classified Archive Launch GUI contains status blocks for the process hosts (upper area with small blocks) and archive processes (lower area with large blocks). Status of the blocks is shown visually by colors and status text in the buttons:

a. green = running

b. red = stopped

c. blue = idle

d. burgundy (host) = running/read only

e. burgundy (process) = unknown

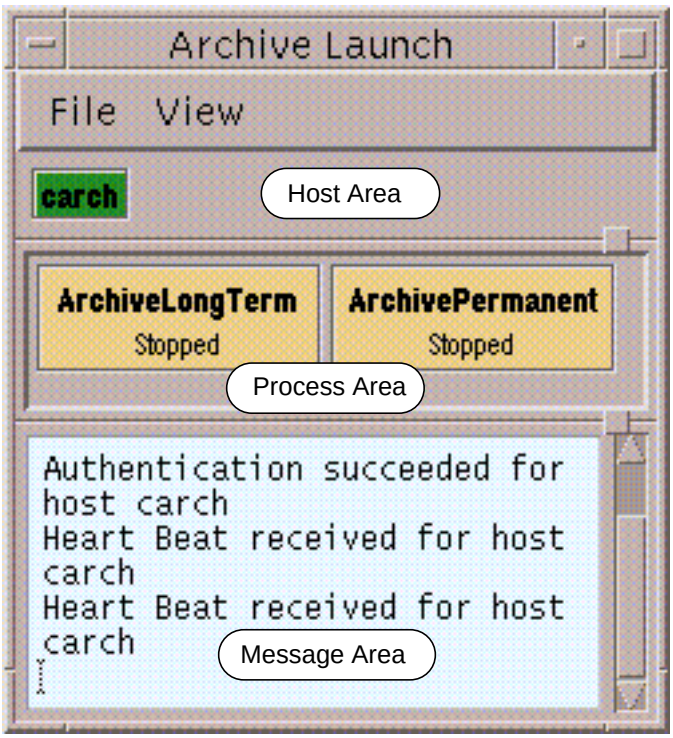

Figure 3-16. Classified Archive Launch GUI

3-77. Right-clicking on any block brings up a menu of actions for that block, giving options to control or status the process.

3-78. The host buttons provide the following selections:

a. **Load**. Starts an xload window for that host.

b. **Login**. Brings up an xterm window for that host.

c. **Start Launch.** Starts the sockd process on the archive machine

d. **Stop Launchd**. Stops the sockd process on the archive machine.

3-79. The process buttons provide the following selections:

a. **Start**. Starts the selected process.

b. **Stop.** Stops the selected process.

c. **Details**. Brings up a window showing the equivalent of a ps command for the process. Not available on Archive/Migrate Date Cron buttons.

d. **Monitor**. Lists the most recent 19 lines of the process log in a new xterm window that scrolls as new lines are added to the log. Not available on Archive/Migrate Date Cron buttons.

e. **List**. Lists the cron process currently running. Available only on Archive/Migrate Date Cron buttons.

3-80. The archive processes are normally started periodically by the UNIX cron utility; however, these processes can also be started manually by the operator.

3-81. UNCLASSIFIED/CLASSIFIED ARCHIVE WORKFLOW.

3-82. The Unclassified/Classified Archive WorkFlow GUI allows the operator to monitor the state of the data undergoing archive processing (figure 3-17).The display consists of several rows of colored bricks, where each brick represents a data object in the system having a unique time interval, data class, and name. The color of the interval indicates the state of the data archiving performed on that interval. In this way, the DAM can keep track of the presence of diskloop data and track its progress through the archiving process.

3-83. The following list describes the uses of the Unclassified/Classified Archive WorkFlow elements:

a. History scale bar. Selects the lookback limit for intervals. Only intervals more recent than the current time less the history time can be displayed. The current history time is displayed on the duration/history indicator.

b. Duration scale bar. Selects time span of intervals viewable on the display. The current duration is displayed on the duration/history indicator.

c. Time line scroll bar. Scrolls the portion of the history to be displayed. When the slider is all the way to the right of the scroll bar, the current time appears on the right edge of the time lines. Sliding the scroll bar all the way to the left will display the time span starting with the first available data interval.

d. Process scroll bar. Scrolls the intervals to be displayed if there are too many to show in the pane. The scrolling occurs automatically when the latest intervals are displayed in the window.

e. Message scroll bar. Scrolls the message area if there are too many messages in the pane.

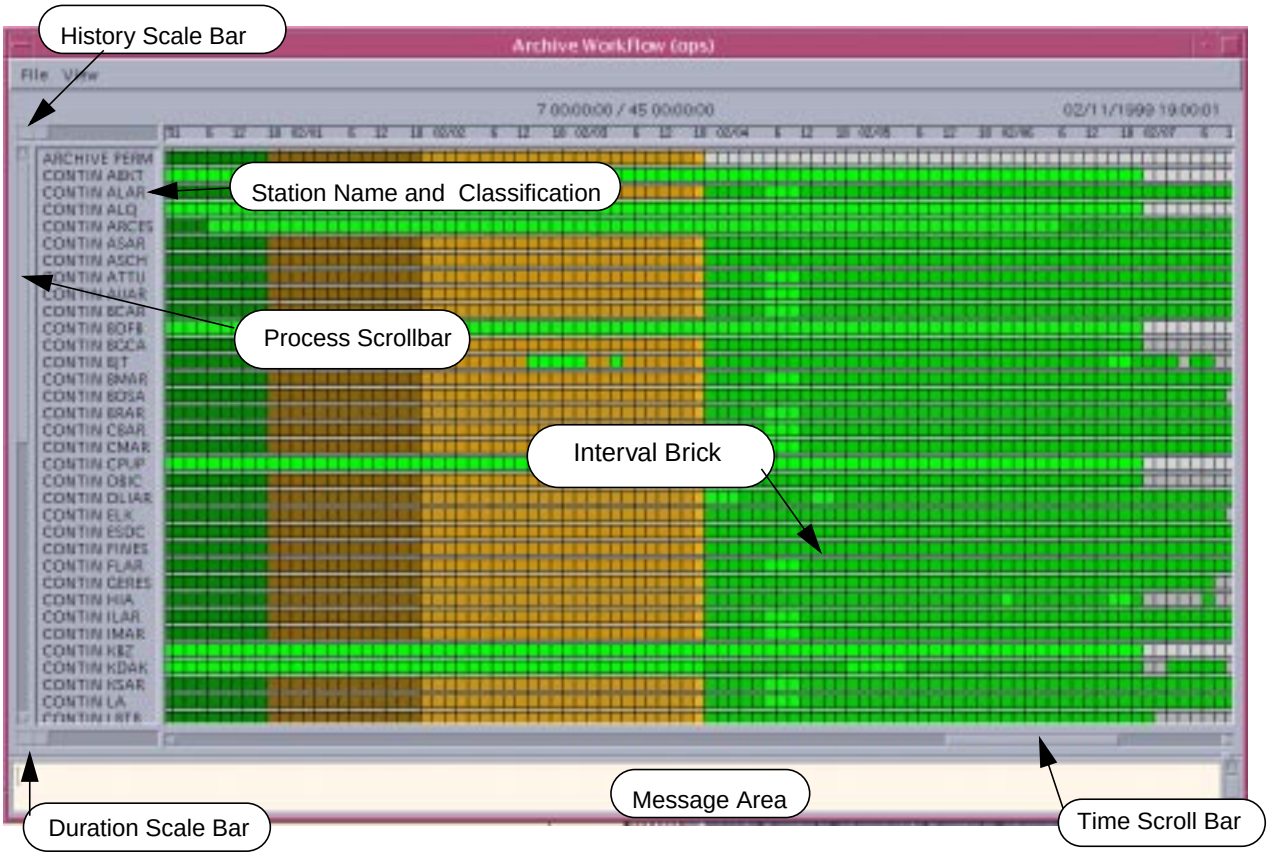

Figure 3-17. Unclassified/Classified Archive WorkFlow (ops) GUI

3-84. The general characteristics of the Classified/Unclassified Archive WorkFlow are:

a. Checks the interval table every 10 seconds, and adds blocks for any new intervals found, or updates the indicators of existing blocks for any status change.

b. Logs operator actions to a scrolling text area seen at the bottom of the window and to log files.

3-85. The application menu bar at the top of the Unclassified/Classified Archive WorkFlow GUI provides the menu buttons **File** and **View**:

a. The **File** menu provides one selection. **Exit** is used to quit the Unclassified/ Classified WorkFlow.

b. The **View** menu provides six selections that are used in conjunction with the scrolling text area seen at the bottom of the Classified/Unclassified Archive WorkFlow GUI:

(1) **Update**. Updates the window immediately instead of waiting for the normal periodic update.

(2) **Reset**. Rereads all information into the Classified/Unclassified Archive WorkFlow GUI as if the application has just started.

(3) **Clear**. Removes all messages from the message area.

(4) **Print**. Prints a hardcopy of the messages in the message area.

(5) **Exception**. Brings up a list of intervals in an exception state.

(6) **State Color Codes**. Brings up a list of color codes and their interpretations for reference.

3-86. The **Exception** popup window (figure 3-18) is selected from the **View** menu. It is a scrollable window containing blocks (duplicates of blocks found in the WorkFlow GUI) that are currently in an exception state.

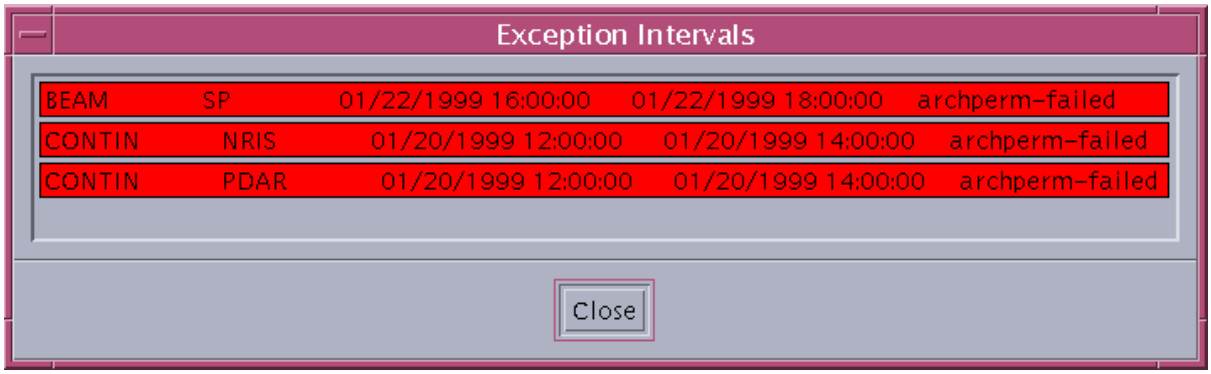

Figure 3-18. Exception Intervals Popup Window

3-87. The **State Color Dialog** popup window (figure 3-19) is selected from the **View** menu. It shows all state names and colors used in the Unclassified/Classified WorkFlow GUI.

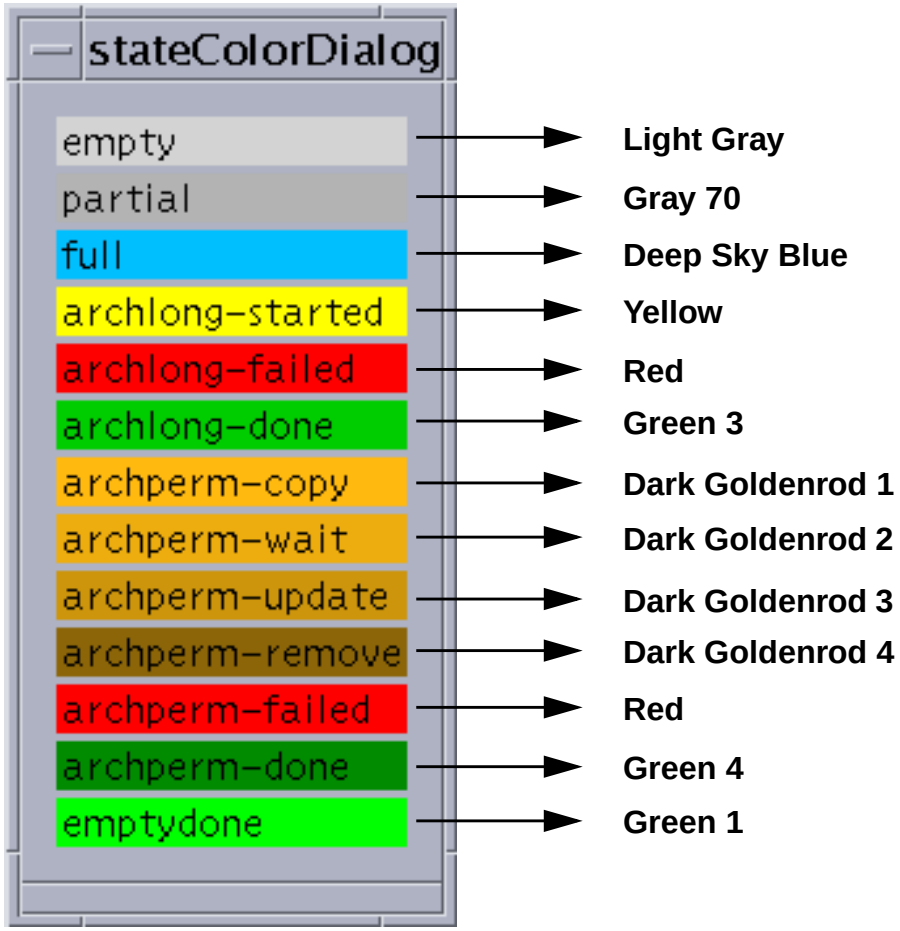

Figure 3-19. State Color Dialog Popup Window

3-88. Each interval brick in Classified/Unclassified Archive WorkFlow has an associated popup menu (figure 3-20) that is displayed by right-clicking on the interval. The popup provides one action: **Update Interval State**.

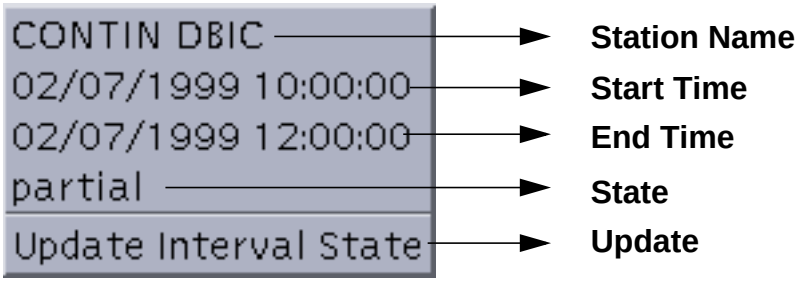

Figure 3-20. Interval Popup Window

3-89. UNCLASSIFIED SYSTEM OPERATING INSTRUCTIONS.

3-90. The primary function of the Unclassified DAM operator is to monitor the operation of the host processors and processes of the Unclassified System. The Unclassified Launch and WorkFlow GUIs are provided to enable the operator to perform that function. The Launch GUIs (Data Acquisition, Data Acquisition Cron, and Archive) provide a quick check of the health of the processing system. Host processors and processes that should be running as indicated by a green button (excluding any process button that is light blue) and are not running (red), indicate a problem that needs to be investigated. The WorkFlow GUIs (Data Acquisition and Archive) provide a quick check of the state of the data.

3-91. LOGON.

3-92. Initialize DAM operation as follows:

a. Login to the machine to be used to perform DAM functions.

b. The CDE screen will come up and each of the Unclassified Data Acquisition, Archive, and Launch GUIs will be initiated in their respective work areas.

c. The Workflow GUIs will take several minutes to come up and the Launch GUIs will come up in about 30 seconds.

3-93. UNCLASSIFIED DATA ACQUISITION WORKFLOW MONITORING.

3-94. To monitor the processes involved in unclassified data acquisition, proceed as follows:

a. Move to the Acquisition work area by selecting **Acquisition** from the CDE. The Unclassified Data Acquisition Workflow GUI should be up and running in the work area. If the Unclassified Data Acquisition Workflow GUI is not up and running, proceed as follows:

(1) Open an xterm window.

(2) From the xterm window, type:

```
start_workflow type=DA↵
```

- - NOTE - -

The Unclassified Data Acquisition Workflow GUI may take several minutes to come up.

b. Review the Unclassified Data Acquisition Workflow GUI. Acquisition should be near real-time (within ten minutes of current time).

c. If the Unclassified Data Acquisition Workflow GUI indicates that one or more of the stations are behind, make note of each station that is behind, then troubleshoot as described in chapter 5.

3-95. UNCLASSIFIED ARCHIVE WORKFLOW MONITORING.

3-96. To monitor the state of unclassified archiving, proceed as follows:

a. Move to the Archive work area by selecting **Archive** from the CDE. If the Unclassified Archive Workflow GUI is not up and running, proceed as follows:

(1) Open an xterm window.

(2) From the xterm window, type:

```
start_workflow type=Arch↵
```

- - NOTE - -

The Unclassified Archive WorkFlow GUI may take several minutes to come up.

b. There are three things the operator should check periodically to monitor the archiving:

(1) Check for email. If there are any email messages from ArchiveLongTerm or ArchivePermanent, troubleshoot as described in chapter 5.

(2) Check for exception intervals by selecting **View**⇒**Exception**. If there are intervals displayed in the **Exception Interval** popup window, troubleshoot as described in chapter 5.

(3) Check the Archive WorkFlow GUI to ensure that intervals are being created every two hours. If there are no intervals within four hours of real-time, troubleshoot as described in chapter 5.

3-97. UNCLASSIFIED DATA ACQUISITION LAUNCH MONITORING.

3-98. To monitor the processes involved in unclassified data acquisition, proceed as follows:

a. Move to the Launch work area by selecting **Launch** from the CDE. If the Data Acquisition Launch GUI is not up and running, proceed as follows:

(1) Open an xterm window.

(2) From the xterm window, type:

`start_launch type=fwd`↵

b. Review the Forward Launch GUI. The host buttons should be green and the process buttons should be green or blue.

c. If one or more of the host or process buttons is red, troubleshoot as described in chapter 5.

3-99. UNCLASSIFIED ARCHIVE LAUNCH MONITORING.

3-100. To monitor the processes involved in unclassified archiving, proceed as follows:

a. Move to the Launch work area by selecting **Launch** from the CDE. If the Archive Launch GUI is not up and running, proceed as follows:

(1) Open an xterm window.

(2) From the xterm window, type:

`start_launch type=Arch`↵

b. Review the Archive Launch GUI. The host button should be green and the process buttons should be green or blue.

c. If one or more of the host or process buttons is red, troubleshoot as described in chapter 5.

3-101. CLASSIFIED SYSTEM OPERATING INSTRUCTIONS.

3-102. The primary function of the Classified DAM operator is to monitor the operation of the host processors and processes of the Classified System. The Classified Launch and WorkFlow GUIs are provided to enable the operator to perform that function. The Launch GUIs (Data Acquisition, Data Acquisition Cron, and Archive) provide a quick check of the health of the processing system. Host processors and processes that should be running as indicated by a green button (excluding any process button that is light blue) and are not running (red), indicate a problem that needs to be investigated. The WorkFlow GUIs (Data Acquisition and Archive) provide a quick check of the state of the data.

3-103. LOGON.

3-104. Initialize DAM operation as follows:

a. Login to the machine to be used as the DAM.

b. The CDE screen will come up and each of the Classified Data Acquisition, Archive and Launch GUIs will be initiated in their respective work areas.

c. The Workflow GUIs will take several minutes to come up and the Launch GUIs will come up in about 30 seconds.

3-105. CLASSIFIED DATA ACQUISITION WORKFLOW MONITORING.

3-106. To monitor the state of classified data acquisition, proceed as follows:

a. Move to the Acquisition work area by selecting **Acquisition** from the CDE. The Classified Data Acquisition Workflow GUI should be up and running in the work area. If the Classified Data Acquisition Workflow GUI is not up and running, proceed as follows:

(1) Open an xterm window.

(2) From the xterm window, type:

`start_workflow type=DA`↵

- - NOTE - -

The Classified Data Acquisition WorkFlow GUI may take several minutes to come up.

b. Review the WorkFlow GUI. Acquisition should be near real-time (within 10 minutes of current time).

c. If the Classified Data Acquisition Workflow GUI indicates that one or more of the stations are behind, make note of each station that is behind and troubleshoot as described in chapter 5.

3-107. CLASSIFIED ARCHIVE WORKFLOW MONITORING.

3-108. To monitor the state of the classified archive, proceed as follows:

a. Move to the Archive work area by selecting **Archive** from the CDE. If the Classified Archive WorkFlow GUI is not up and running, proceed as follows:

(1) Open an xterm window.

(2) From the xterm window, type:

`start_workflow type=Arch`↵

- - NOTE - -

The Classified Archive WorkFlow GUI may take several minutes to come up.

b. There are three things that the operator should check periodically to monitor the archiving:

(1) Check for email. If there are any email messages from ArchiveLongTerm or ArchivePermanent, troubleshoot the problem as described in chapter 5.

(2) Check for exception intervals by selecting **View⇒Exception**. If there are intervals displayed in the **Exception Interval** popup window, troubleshoot as described in chapter 5.

(3) Check the Classified Archive WorkFlow GUI to make sure that intervals are being created every two hours. If there are no intervals within four hours of real-time, troubleshoot as described in chapter 5.

3-109. CLASSIFIED DATA ACQUISITION LAUNCH MONITORING.

3-110. To monitor the processes involved in classified data acquisition, proceed as follows:

a. Move to the Launch work area by selecting **Launch** from the CDE. If the Classified Data Acquisition Launch GUI is not up and running, proceed as follows:

(1) Open an xterm window.

(2) From the xterm window, type

`start_launch type=DA`↵

b. Review the Classified Data Acquisition Launch GUI. The host buttons should be green and the process buttons should be green or blue.

c. If one or more of the host or process buttons is red, troubleshoot as described in chapter 5.

3-111. CLASSIFIED ARCHIVE LAUNCH MONITORING.

3-112. To monitor the processes involved in classified archiving, proceed as follows:

a. Move to the Launch work area by selecting **Launch** from the CDE. If the Classified Archive Launch GUI is not up and running, proceed as follows:

(1) Open an xterm window.

(2) From an xterm window, type:

`start_launch type=Arch` ↵

b. Review the Classified Archive Launch GUI. The host button should be green and the process buttons should be green or blue.

c. If one or more of the host or process buttons is red, troubleshoot as described in chapter 5.

3-113. DAM SHUTDOWN PROCEDURES.

3-114. The US NDC system operates continuously. Therefore, shutdown of the entire system is an unusual event caused by abnormal conditions, such as hardware maintenance, unexpected or expected loss of electrical power, or other emergency. If a shutdown is needed, it should be performed by the system maintenance personnel, if possible.

3-115. GRACEFUL DAM SHUTDOWN.

3-116. Normally the DAM operates continuously. The expected circumstances in which the Data Acquisition Processing would be shut down on a non-emergency basis are:

a. System reconfiguration, including switch over between the A and B systems.

b. Planned downtime, such as a hurricane evacuation or planned power outage.

c. Other shutdown with at least 30 minutes advance notice.

3-117. Soft or graceful shutdown of equipment is to be performed if possible to promote data integrity when the system is restarted. An emergency shutdown of equipment should be avoided in favor of an orderly shutdown if at all possible for the following reasons:

a. Restoration of mission capability typically requires 30 minutes or more.

b. Some data files may become lost or corrupted, further impairing return to normal operations.

3-118. In order to accomplish a udam shutdown on a non-emergency basis, perform the following steps after logging on with the udam password at the unclassified udam station:

a. Using the udam DA Launch GUI, stop all process types by right-clicking on **Stop** in the corresponding process bricks.

b. Using the udam DA Cron Launch GUI, stop all process types by right-clicking on **Stop** in the corresponding process bricks.

c. Using the udam Forward Launch GUI, stop all process types by right-clicking on **Stop** in the corresponding process bricks.

d. Using the udam Gap Launch GUI, stop all process types by right-clicking on **Stop** in the corresponding process bricks.

e. Using the udam Archive Launch GUI, stop all process types by right-clicking on **Stop** in the corresponding process bricks.

f. Wait until all running processes have stopped.

- - NOTE - -

Stopping the udam processors is optional. Consult with maintenance personnel before performing the next step.

g. Stop the udam processors by right-clicking on **Stop Launchd** in each Launch display.

3-119. Notify maintenance personnel the udam has been shut down and power-off procedures can be started.

3-120. In order to accomplish a cdam shutdown on a non-emergency basis, perform the following steps after logging on with the cdam password at the Classified DAM station:

a. Using the cdam DALaunch GUI, stop all process types by right-clicking on **Stop** in the corresponding process bricks.

b. Using the cdam DACron Launch GUI, stop all process types by right-clicking on **Stop** in the corresponding process bricks.

c. Using the cdam Forward Launch GUI, stop all process types by right-clicking on **Stop** in the corresponding process bricks.

d. Using the cdam Archive Launch GUI, stop all process types by right-clicking on **Stop** in the corresponding process bricks.

e. Wait until all running processes have stopped.

- - NOTE - -

Stopping the cdam processors is optional. Consult with maintenance personnel before performing the next step.

f. Stop the cdam processors by right-clicking on **Stop Launchd** in each Launch display.

g. Notify maintenance personnel the cdam has been shut down and power-off procedures can be started.

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SECTION II

SYSTEM OPERATIONS MANAGER

3-121. GENERAL.

3-122. The SOM controls Classified System operations associated with processing and preservation of seismic and hydroacoustic data (pipeline processing). The pipeline processing is highly automated. Once the pipeline is started, very little intervention by the SOM is normally needed. SOM operations consist primarily of monitoring the visual displays that show the status of the automatic processing. When a problem is discovered by, or reported to, the SOM, the response may be a prescribed action or a request for action by maintenance personnel. The SOM monitoring capabilities include monitoring the state of each pipeline process using the WorkFlow GUI to ensure the pipelines continue to operate near real-time. The Launch GUI is used, where necessary, to stop or start a pipeline.

3-123. LIST OF PROCEDURES.

3-124. Basic procedures covered in this section are listed in alphabetical order with paragraph locations shown in table 3-1.

Table 3-1. Procedure Lists

PROCEDURE	TYPE	PARAGRAPH
Alerts and Bulletins	Action	Refer to paragraph 3-251.
Catch-up Pipeline Processing	Action	Refer to paragraph 3-194.
Change Single Interval State	Action	Refer to paragraph 3-211.
Change Multiple Interval States	Action	Refer to paragraph 3-212.
Create New Intervals	Action	Refer to paragraph 3-207.
Detachment 460 data	Action	Refer to paragraph 3-239.
Check Exception Interval	Action	Refer to paragraph 3-216.
Event Warning	Action	Refer to paragraph 3-258.
Initial System Startup	Action	Refer to paragraph 3-187.
Monitor Pipeline WorkFlow GUI	Monitor	Refer to paragraph 3-196.
Pipeline Startup	Action	Refer to paragraph 3-192.
Process Very Late Data	Action	Refer to paragraph 3-237.
Shut Down Pipeline	Action	Refer to paragraph 3-266.
Switch Out Processor	Action	Refer to paragraph 3-272.

3-125. CONTROLS AND INDICATORS.

3-126. The SOM station can be any one- or two-headed classified station which is configured for use in analysis. The SOM can switch to another station without any impact to the processing. The operator is presented with the CDE after logging on to a station. The initial appearance of the desktop is shown in figure 3-21. A Pipeline or Data Acquisition WorkFlow GUI will appear in the appropriate workspace within two minutes.

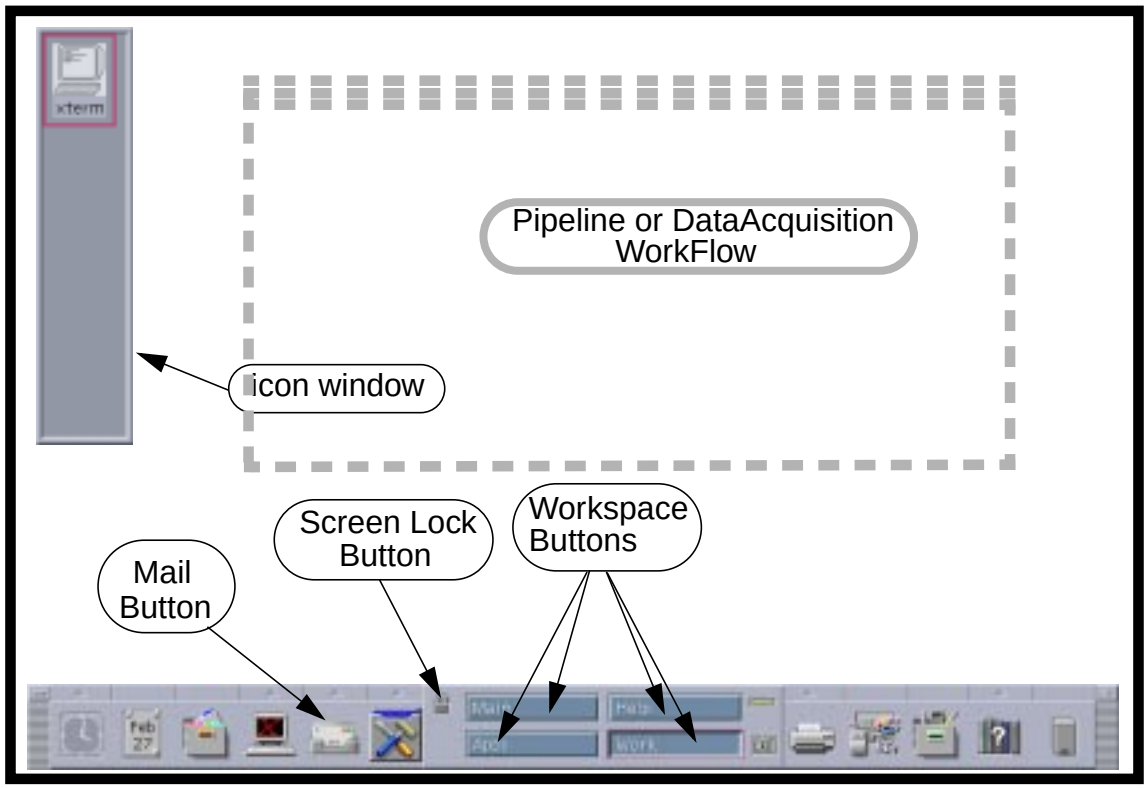

Figure 3-21. CDE Appearance

3-127. The desktop provides multiple workspaces, each of which may be changed by the operator. The Pipeline workspace (shown in figure 3-21) is used primarily for pipeline process monitoring and control through a WorkFlow window. Another workspace may be used for pipeline control through a Launch window. Two additional workspaces exist for related activities of the SOM, such as email exchange, monitoring data acquisition, and performing database queries. The workspace is selected by left-clicking on the desired workspace button.

3-128. The screen lock button locks up the keyboard and blanks the display until the password is entered in the dialog box. To reopen, move the mouse or touch a keyboard key to bring up the password box.

3-129. A two-headed analyst station does not have the CDE on the second display.

3-130. ROOT MENU.

3-131. The root menu pops up when the operator clicks any mouse button in the background area of one of the desktops on the station. The root menu provides access to most of the commonly used operator functions. The appearance of the root menu and all its submenus is shown in figure 3-22. The main menu items are:

a. **New Window**. Opens a new xterm window in the current workspace.

b. **Launch**. Brings up the Pipeline **Launch** submenu.

c. **WorkFlow**. Brings up the Pipeline **WorkFlow** submenu.

d. **Process Orid.** Brings up an Engage window to process a single origin.

e. **Editors.** Produces a list of the available editors: emacs, Xemacs, Text Editor, and FrameMaker.

f. **Reports.** Produces listings or standard reports from the database: EventList, Bulletin, Alert Brief, or Alert Report.

g. **Utilities.** Produces a list of utility functions: Calculator, Man Pages, News, Audio Tool, Image Viewer, Performance Meter, Calendar Manager, GMT Clock, File Manager, Snapshot, and Print Window.

h. **Refresh**. Refreshes screen display.

i. **Restart Workspace Manager.** Restarts the program manager without logging the user out or killing any processes. This is primarily needed to update the root menu after editing the `$HOME/.dt/dtwmrc`.

j. **Minimize/Restore Front Panel.** Iconifies or expands the panel tool at the bottom of the screen**.**

k. **Exit Session.** Logs the user out and stops all processes started by SOM in that session on the local host. Data transfer processes already running continue running. A verification window will come up before executing the command.

3-132. Submenu items are described later in applicable procedures.

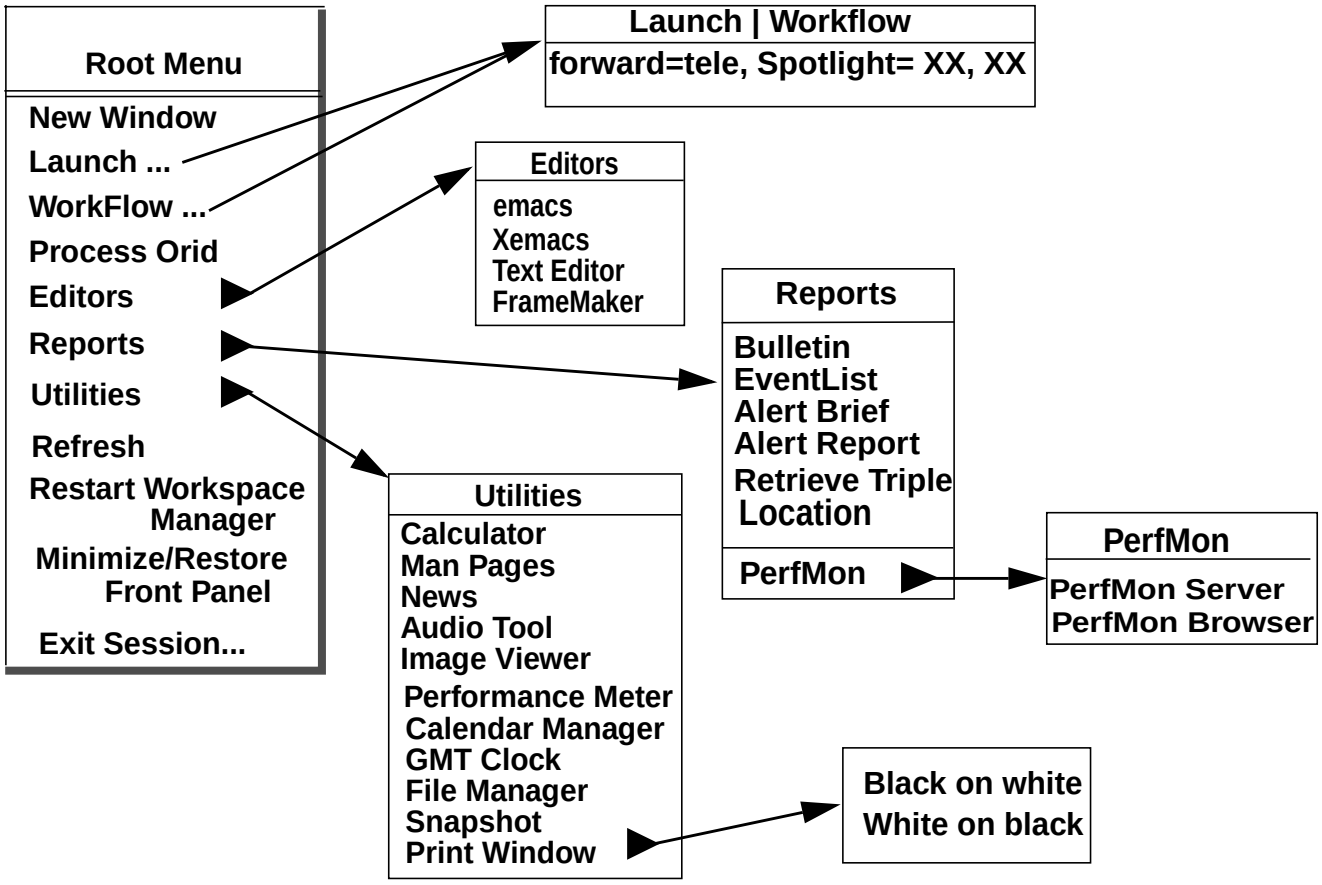

Figure 3-22. Root Menu

3-133. PIPELINE CONTROL WORKSPACE.

3-134. The following windows are available at start-up on the SOM station in the Pipeline Workspace:

a. Pipeline WorkFlow

b. GMT time

c. EventList (appears after GA runs)

d. Desktop manager containing: local time, workspace icons, etc.

e. Icon manager

f. Console window

3-135. OTHER WORKSPACES.

3-136. The remaining three workspaces are available to the SOM to use as desired. Typically, one will be used for Launch windows, whereas another might be used to monitor data acquisition or mail.

3-137. SOM GRAPHIC USER INTERFACES.

3-138. The primary GUI tools available to the SOM are the Pipeline Launch display and the Pipeline WorkFlow GUI. In addition there are popup windows where required data may be entered or chosen from lists. These tools are described within the procedures that use them.

3-139. PIPELINE WORKFLOW GUI.

3-140. The Pipeline WorkFlow GUI (figure 3-23) allows monitoring of data processing in the Classified System and control of processing of individual blocks of data. The display consists of several rows of colored bricks, where each brick represents a data interval. The color of the brick indicates the state of processing performed on the interval. In this way, the SOM can monitor on-time data, near real-time data, the pipeline stages, and the progress of data through the stages of analysis.

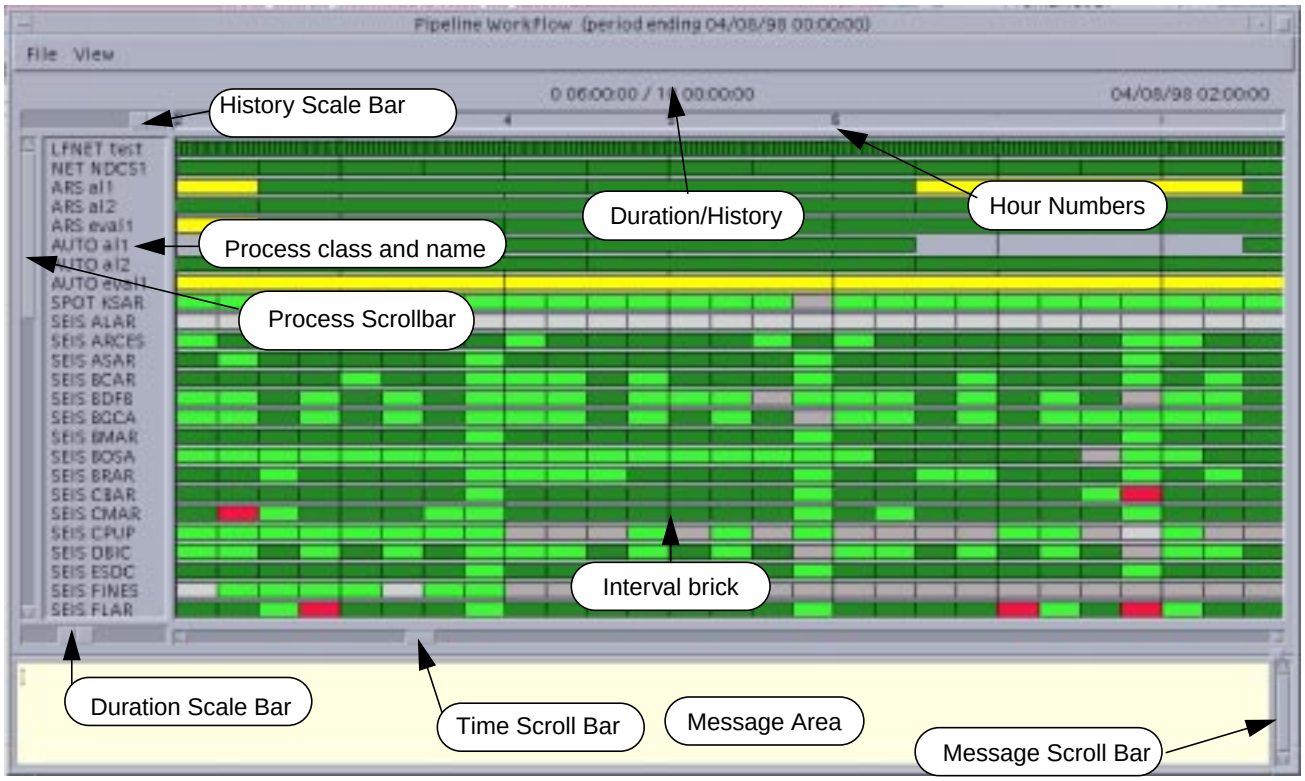

Figure 3-23. Pipeline Workflow GUI

3-141. The general characteristics of Pipeline WorkFlow are:

a. Checks the interval table every 10 seconds, adds blocks for any new intervals found, and updates the indicators for any status change.

b. Provides pull-down menus that permit certain actions to be performed on intervals, such as reprocessing a failed interval.

c. Displays the most recent lines of the logs of operator actions at the bottom of the window.

3-142. The application menu bar at the top of the Pipeline WorkFlow window provides the menu buttons **File** and **View**. The **File** menu provides four selections. The first three pop up an Engage window to allow the operator to specify parameters, and the last is used to exit WorkFlow:

a. **Create Intervals** creates a group of new intervals with a given class.

b. **Change Intervals State** changes the current processing state of a group of intervals with a given class.

c. **Process Intervals** processes a group of intervals with a given class and processing state.

d. **Exit** is used to quit WorkFlow.

3-143. The **View** menu provides six selections, two of which are used in conjunction with the scrolling text area seen at the bottom of the Pipeline WorkFlow window:

a. **Update** updates the window immediately instead of waiting for the normal periodic update.

b. **Reset** rereads all information into Pipeline WorkFlow as if the application had just started.

c. **Clear** removes all messages from the message area.

d. **Print** prints a hardcopy of the messages in the message area.

e. **Exception**. Pops up a list of intervals in an exception state.

f. **State Color Codes** pops up a list of color codes and their interpretations for reference.

3-144. The following list describes the features of the Pipeline WorkFlow GUI (figure 3-23):

a. History scale bar. Selects the lookback limit for intervals. Only intervals more recent than the current time less the history time can be displayed. The current history time is displayed on the duration/history indicator (centered below the title of the window). Moving the button to the right increases the time interval in steps of 24 hours, 48 hours, or 10 days.

b. Duration scale bar. Selects time span of intervals displayed. The current duration is displayed on the duration/history indicator. Moving the button to the right increases the time interval in steps of 4 hours, 12 hours, or 24 hours.

c. Time scroll bar. Scrolls the portion of the history to be displayed. When the slider is all the way to the right of the scroll bar, the current time appears on the right edge of the window. Sliding the scroll bar all the way to the left will display the earliest available data intervals as determined by the history scale bar.

d. Process scroll bar. Scrolls the intervals to be displayed vertically. The scrolling occurs automatically when the latest intervals are displayed in the window.

e. Message scroll bar. Scrolls the message area if the messages extend beyond one pane.

3-145. Each interval brick in the Pipeline WorkFlow has an associated popup menu (figure 3-24). The menu is opened by clicking the right mouse button on the interval. The menu provides actions for changing or copying the interval. The menu also provides actions to initiate processing of the interval and to view the processing logfile. The actions **Edit**, **Copy**, and **Monitor Process** perform a similar function as the corresponding **Change Intervals State**, **Create Intervals**, and **Process Intervals** items from the **File** menu, but for a single interval. Deleting an interval does not actually delete the associated data, it only removes the ability to process and control the associated data through Pipeline WorkFlow.

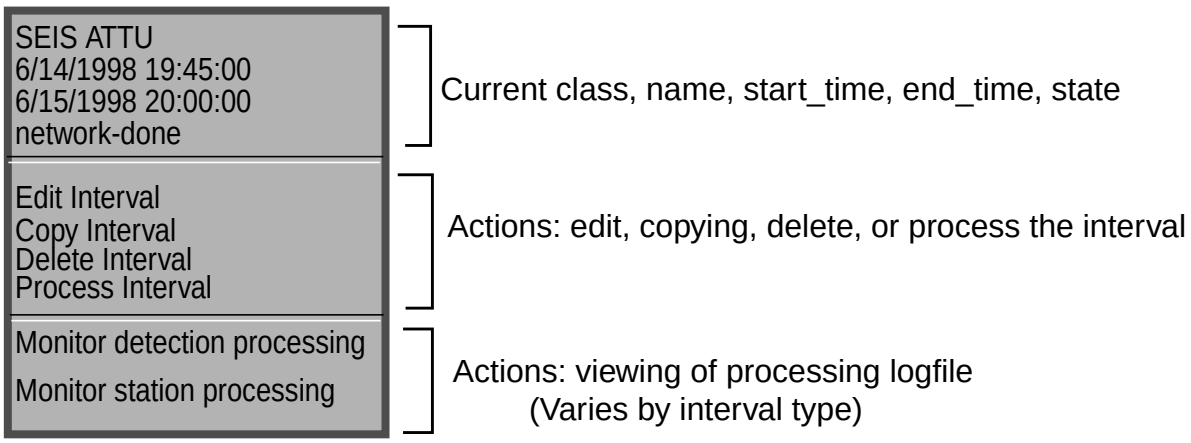

Figure 3-24. Interval Popup Menu

3-146. The list of available actions for interval classes and names is given in table 3-2. All **Monitor** actions bring up an xterm window that shows the most recent lines of text from the processing log of the chosen process. If the log is still being written, the xterm window will automatically scroll as new lines are added.

Table 3-2. Interval Popup Menu Options

INTERVAL CLASS	INTERVAL NAME	POSSIBLE STATES	SOM ACTIONS
ARS	al1 al2 eval1 eval2 baral1	queued | running | done	N/A
All Classes		skipped	N/A
AUTO	al1	queued | origbeamSP-start | origbeamLP-start | arrbeamSP-start | done | failed	Process Monitor origbeamSP Monitor origbeamLP Monitor arrbeamSP
	al2	queued | origbeamSP-start | origbeamLP-start | arrbeamSP-start | mag-start | loc-start | hydroEDP-start | done | failed	Process Monitor origbeamSP Monitor origbeamLP Monitor arrbeamSP Monitor mag Monitor loc Monitor hydroEDP
	eval1	queued | origbeamSP-start | mag-start | loc-start | done | failed	Process Monitor origbeamSP Monitor mag Monitor loc
	eval2	queued | loc-start | done | failed	Process Monitor loc
	baral1	queued | loc-start | done | failed	Process Monitor loc
HYDR	<sta-name>	queued | partial | detect-start | station-done | failed	Process Monitor detection
LFNET	<par-name>	queued | evwarning-start | arrbeamSP-start | network-done | failed	Process Monitor evwarning Monitor arrbeamSP

Table 3-2. Interval Popup Menu Options (Cont)

INTERVAL CLASS	INTERVAL NAME	POSSIBLE STATES	SOM ACTIONS
LFSEIS	<sta-name>	queued | detect-start | station-done | failed	Process Monitor detection
NET	<net-name>	queued | partproc-start | assoc-start | conflict-start | origbeamSP-start | arrbeamSP-start | network-done | failed	Process Monitor partproc Monitor assoc Monitor conflict Monitor origbeamSP Monitor arrbeamSP
BNET	<net-name>	queued | partproc-start | assoc-start | conflict-start | origbeamSP-start | arrbeamSP-start | origbeamLP-start | arrbeamLP-start | network-done | failed	
SEIS	<sta-name>	queued | partial | detect-start | stapro-start | filterBBLP-start | station-done | al1-done | al2-done | eval1-done | eval2-done | failed	Process Monitor detection Monitor stapro Monitor filterBBLP
SPOT	<sta-name>	queued | partial | detect-start | stapro-start | station-done	Process Monitor detection Monitor station
ARRV	NEIC TTYcvt NB2	queued | station-done | failed	Process Monitor processing

3-147. The State Color Codes popup window is selected from the **View** menu. This window is used as a quick reference to show the set of all state names and state colors used in the Pipeline WorkFlow GUI. Since colors are not shown in this manual, the position of the color name is used as a guide to the color. See the station display for the true colors.

3-148. The state-indicating colors in Pipeline WorkFlow have the colors shown in figure 3-25. The color codes are always available by selecting **View⇒State Color Codes** from the Pipeline WorkFlow menu bar.

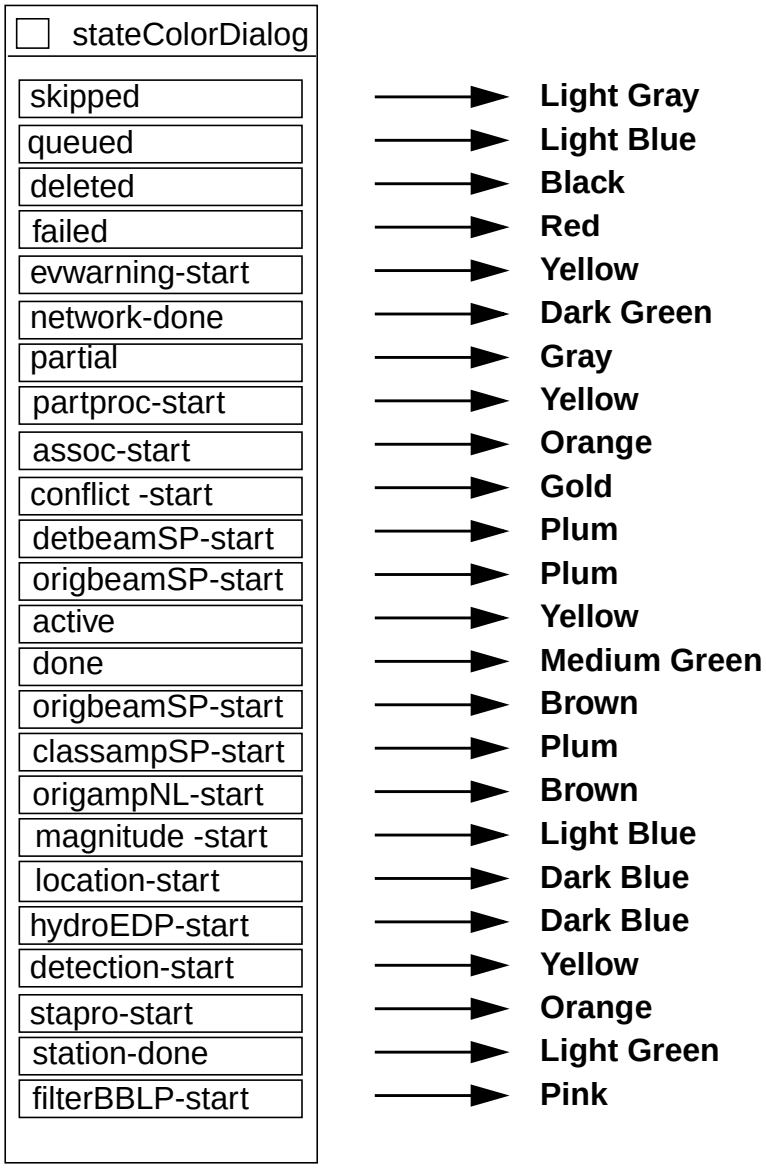

Figure 3-25. Pipeline State Color Codes Popup Window

3-149. CREATE INTERVALS POPUP WINDOW.

3-150. The **Create Intervals** popup window selected from the Pipeline Workflow **File** menu is shown in figure 3-26. This window allows the operator to create more than one interval at a time and provides lists from which to choose the parameters for each request. Clicking with the left mouse button on a list icon to the left of each text box brings up the list of possible entries. If a box has an entry when the window pops up, it is the default value. The lists of possible values for the various text boxes are explained in the next paragraphs.

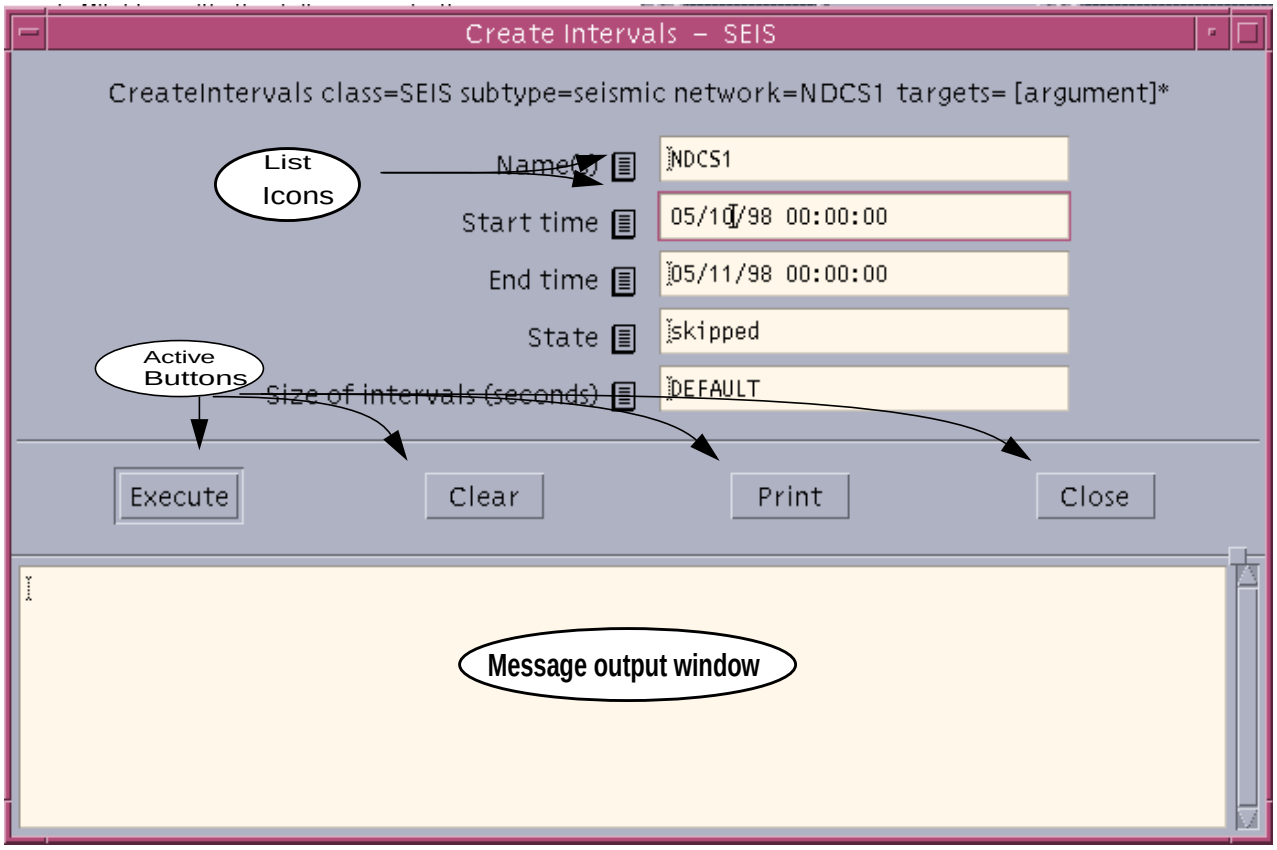

Figure 3-26. Create Intervals Popup Window

3-151. The choices for the **Name** field are dependent on the class selected from the **Create Intervals** menu. For the Analyst Review Station (ARS) and AUTO classes the names are: al1, al2 and eval1. For the NET class, the current seismic-network name is the only selection. For the SEIS class the names include the name of the current seismic-network and the list of individual stations in that network. For the HYDR class the names include the name of the current hydro-network and the list of individual stations in that network. In both cases, the selection of the network name causes intervals to be created for each station in the network.

3-152. The **Start time** and **End time** fields pop up a dialogue that allows the user to pick the approximate date and time, which can then be edited with the keyboard.

3-153. The choices for the **State** field like the **Names** field are also dependent on the class selected from the **Create Intervals** menu. The state field will include the names of the processing states applicable to the class, and some of the following more common states:

a. Deleted. Interval no longer exists.

b. Queued. Set to run when a processor is available.

c. Active. Processing of the interval is underway.

d. Failed. Process has stopped with an error.

e. Partial. Tis interval does not yet contain enough data to be processed.

f. Skipped. Not all station data available for tis interval processing.

- - NOTE - -

Creating intervals will not cause processing to be performed on the interval. The processing must be manually started through a separate action such as is described in paragraph 3-228.

3-154. The choices for the **Size of Intervals** field are in seconds:

a. Default. Default size for the specified interval class in seconds.

b. 900 (15 minutes)

c. 1800 (30 minutes)

d. 7200 (2 hours)

3-155. CHANGE INTERVALS STATE POPUP WINDOW.

3-156. The **Change Intervals State** popup window selected from the WorkFlow **File** menu is shown in figure 3-27. This window allows the operator to change the state of more than one interval at a time and provides lists from which to choose the parameters for each request. Clicking with the select button on a list icon to the left of each text box brings up the list of possible entries. If a box has an entry when the window pops up, it is the default value. The choices for **Start time**, **End time**, and **State** are the same as for the **Create Intervals** popup.

3-157. PROCESS INTERVALS POPUP WINDOW.

3-158. Multiple intervals can be reprocessed in a single submission using the **Process Intervals** item of the **File** menu. The popup dialog is shown in figure 3-28. This window provides the operator with a way to cause WorkFlow to send processing request messages to the appropriate Process Manager (PM), as though they actually came from a tis, tin or ARS process. The window allows the operator to process more than one interval at a time and provides lists from which to choose the parameters for each request. Text boxes are filled in with default values where applicable, and clicking with the left mouse button on the list icon to the left of each text box brings up the list of possible entries. The choices for **Start time**, **End time**, and **State** are the same as for the **Create Intervals** popup.

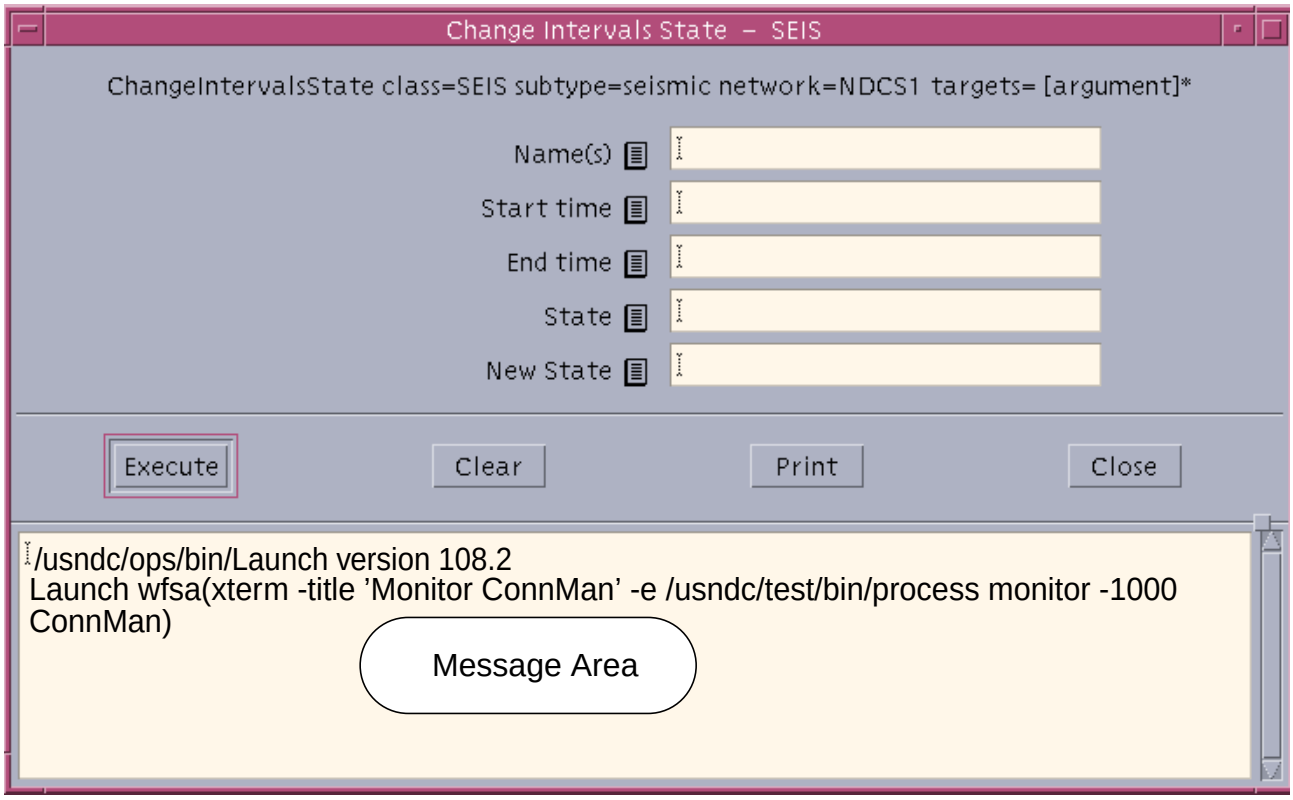

Figure 3-27. Change Intervals State Popup Window

3-159. The **Detection Time Cutoff** field offers two choices: Normal and Complete. Normal is the default. If Complete is entered, detection processing is delayed until the station intervals are 100 percent full. Depending on the current configuration, Normal may be set to 100 percent, giving this parameter a fixed value.

3-160. The **Sleep Time** field causes a delay in the start of processing for the intervals in the time period. A delay is appropriate if data is not yet completely in or if the interval is of the NET type, which is dependent on the completion of earlier processes. Any number of seconds can be entered. The usual choices for the **Sleep time** field are:

a. 2. Pause two seconds before the start of processing of each interval.

b. 60. Pause 60 seconds before the start of processing of each interval.

c. 900. Pause 15 minutes before the start of processing of each interval.

d. 1800. Pause 30 minutes before the start of processing of each interval.

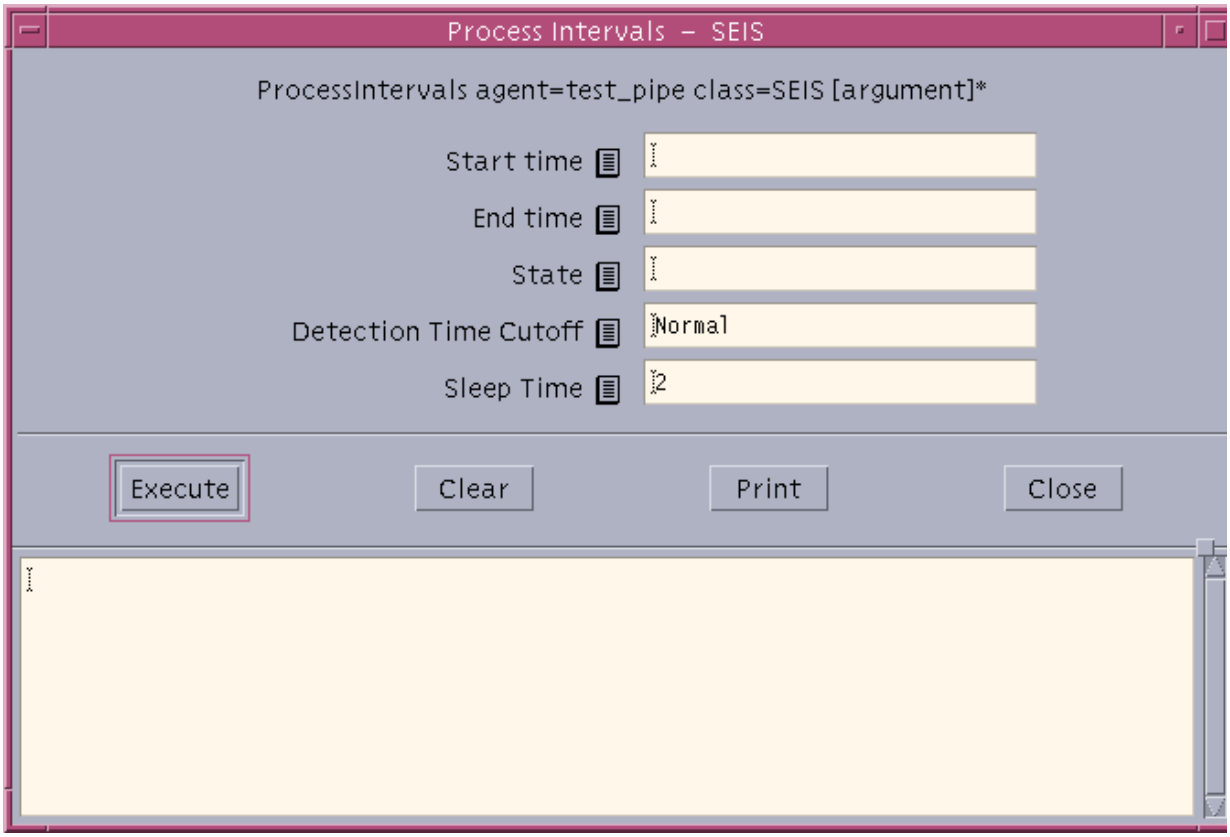

Figure 3-28. Process Intervals Popup Window

3-161. EXCEPTION INTERVALS POPUP WINDOW.

3-162. Intervals that are in an abnormal processing state are identified as Exception Intervals. Currently, the only abnormal state is failed, colored red. Exception Intervals are colored red in the all Pipeline WorkFlow GUIs. The action to be taken depends on an analysis of the type of exception. The list of Exception Intervals is a convenience to provide a single viewing location for all Exception Intervals. The value of the Exception List is that no scrolling of the WorkFlow window is required to locate all Exception Intervals.

3-163. The Exception Intervals popup window is shown in figure 3-29. The Exception List can be used to process and/or move intervals that are in an exception state, meaning that they are in an abnormal processing state for that type of interval. This window allows the operator to quickly examine all intervals in an exception state and to perform tasks on intervals that require attention.

3-164. The Exception List is a scrollable window containing blocks which are duplicates of blocks found in the Pipeline WorkFlow GUI that are currently in an exception state. Right-clicking on the block in either window will bring up the same popup menu of choices associated with that type of interval in the Pipeline WorkFlow GUI.

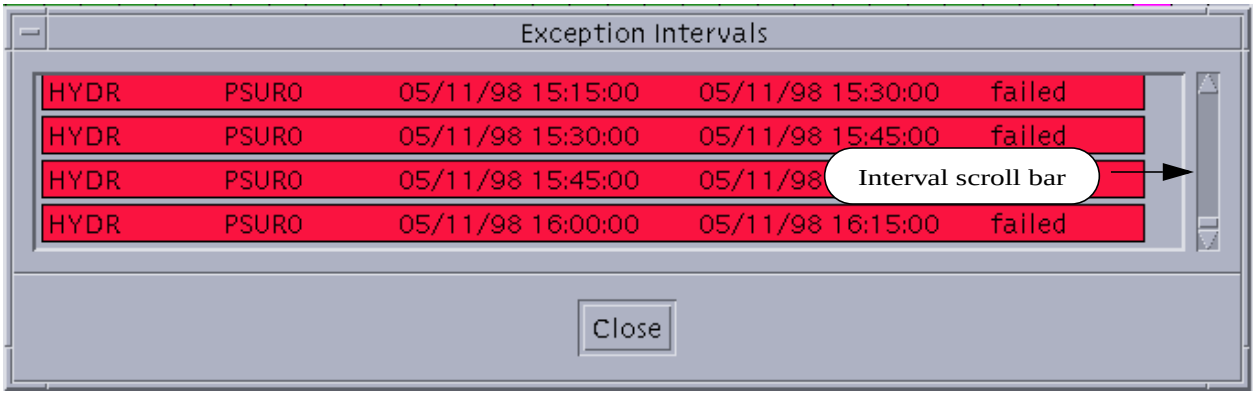

Figure 3-29. Exception Intervals Popup Window

3-165. CLASSIFIED DATA ACQUISITION WORKFLOW GUI.

3-166. The Data Acquisition WorkFlow window on the classified side of the US NDC is used to track, by means of a graphic display, the data available on the classified side. Data intervals received by the Unclassified System, where applicable, are shown for comparison. This allows high-level tracking of the data received from unclassified sources against the data received through the diode on the classified side. The SOM station displays the Data Acquisition WorkFlow window to assist the SOM in identifying problems that might be associated with data acquisition.

3-167. The slider controls in the Data Acquisition WorkFlow GUI are identical to those in the Pipeline WorkFlow GUI. There are only two state colors: blue for received-unclassified and green for received-classified (figure 3-30).

3-168. CLASSIFIED ARCHIVE WORKFLOW WINDOW.

3-169. Discussion of the archiving software is located in section I.

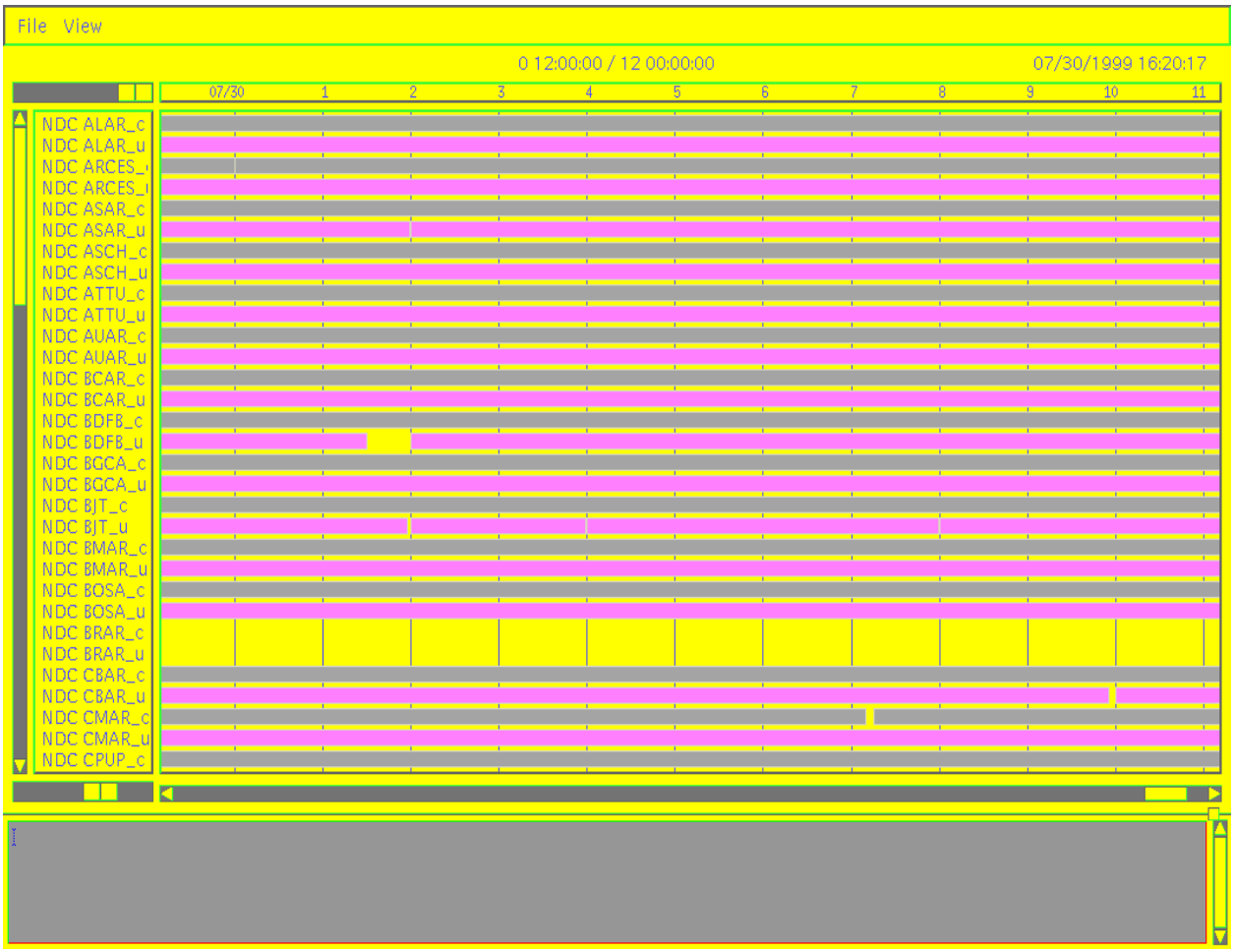

Figure 3-30. Data Acquisition WorkFlow Window

3-170. PIPELINE LAUNCH GUI.

3-171. The Pipeline Launch GUI in figure 3-31 provides the operator with the ability to start and stop key processes as well as to determine the status of processing machines and individual processes involved in pipeline processing in the Classified System. The application menu bar at the top of the Pipeline Launch GUI provides the menu buttons **File** and **View**. The **File** menu has one menu item (**Exit**), which is used to quit Pipeline Launch. The **View** menu has two menu items, which are used in conjunction with the scrolling text area seen at the bottom of the Pipeline Launch GUI:

a. **Clear** removes all messages from the message area.

b. **Print** prints a hardcopy of the messages in the message area.

Figure 3-31. Pipeline Launch GUI

3-172. The Pipeline Launch GUI contains status blocks for both hosts (upper area with small blocks) and processes (lower area with large blocks). Status of the blocks is shown visually by colors and status text in the buttons:

a. green = running

b. red = stopped

c. blue = idle

d. burgundy (host) = running/read only

e. burgundy (process) = unknown

3-173. Clicking on any of the blocks with the right mouse button pops up a menu of actions for that block giving options to control or status the process.

3-174. The host buttons provide the following selections:

a. **Start Launchd**. Starts the Pipeline Launch dman.

b. **Stop Launchd**. Stops the Pipeline Launch dman.

c. **Load**. Starts an xload window for the host.

d. **Login**. Brings up an xterm window logged on to that host.

3-175. The process buttons provide the following selections:

a. **Monitor**. Lists the most recent lines of the process log in a new xterm window that scrolls as new lines are added to the log.

b. **Start**. Starts the process (not available in all intervals).

c. **Stop**. Stops the process gracefully.

d. **Kill.** Stops the process immediately

e. **Details**. Pops up a window showing the equivalent of a ps command for the process.

3-176. The CommAgent, PM, and all PMshell processes seen in this window are started automatically by dman as needed, and cannot be started from Pipeline Launch. Their popup menus will show the limited options available to control and monitor the processes. Some processes are only run on an as-needed basis, rather than continuously. Such processes show stopped (blue) status to indicate that they are configured into the pipeline but idle. The processes that can be started from the Pipeline Launch GUI via operator action are:

a. Isis. Interprocess communications program.

b. dman ops_pipe. Pipeline operations Distributed Applications Control System (DACS) Manager.

c. SEIS tis. Global station processing.

d. SEIS tis part. Tags partial data intervals for station processing.

e. HYDR tis. Accomplishes hydroacoustic station processing.

f. HYDR tis par. Tags partial data intervals for hydroacoustic station processing.

g. NET tin. Manages intervals for Global Network Interval Processing.

h. LFNET ticron. Starts Look-Forward Network Processing every 2 minutes.

i. BNET. Manages intervals for BARM Network Interval Processing.

3-177. PIPELINE CRON LAUNCH.

3-178. The Pipeline Cron Launch GUI (figure 3-32) provides the operator the ability to start and stop processes (logdir.cron, perfmon.cron, arrivals.cron), and to determine the status of processing machines and individual processes involved in pipeline processing in the Classified System.

3-179. The application menu bar at the top of the Pipeline Cron Launch GUI provides the menu buttons **File** and **View**:

a. The **File** menu displays one selection: **Exit**. Used to quit Pipeline Cron Launch.

b. The **View** menu provides two selections that are used in conjunction with the scrolling text area seen at the bottom of the Launch window:

(1) **Clear.** Removes all messages from the message area.

(2) **Print.** Prints the messages in the message area.

3-180. The Pipeline Cron Launch window contains status blocks for the process host (upper area with small block) and processes (lower area with large blocks). Status on the blocks is shown visually by colors and status text in the buttons:

a. green = running

b. red = stopped

c. blue = idle

d. burgundy = unknown

e. burgundy (host) = running/read only

f. burgundy (process) = unknown

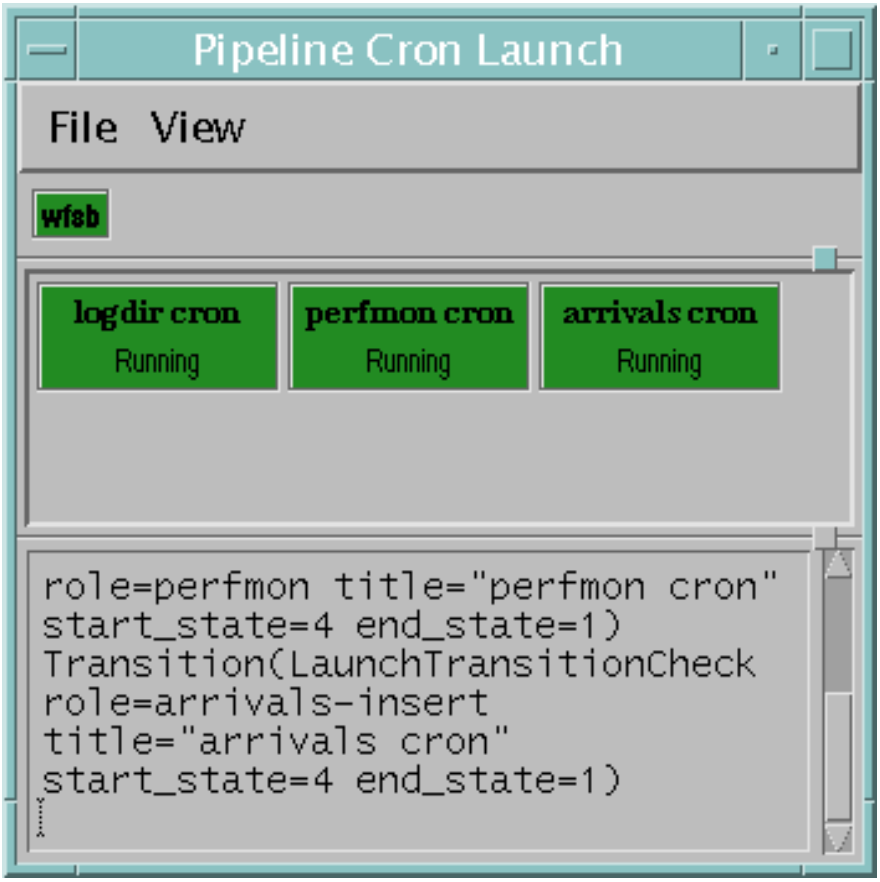

Figure 3-32. Pipeline Cron Launch GUI

3-181. Right-clicking on any block brings up a menu of actions for that block, giving options to control or status the process.

3-182. The host button provides the following selections:

a. **Load**. Starts an xload window for that host.

b. **Login**. Brings up an xterm window for that host.

c. **Start Launchd**. Starts the Launchd_sockd process.

d. **Stop Launchd**. Stops the Launchd_sockd process.

3-183. The process buttons provide the following selections:

a. **Start**. Installs the cron entries into operation.

b. **Stop**. Removes the cron entries from operation.

c. **List**. Lists the cron jobs running.

3-184. The processes seen in the Pipeline Cron Launch GUI are started automatically, but can be started and stopped as needed. Some blocks are blue to indicate that process is only run on an as-needed basis.

3-185. OPERATING INSTRUCTIONS.

3-186. The following paragraphs specify the procedures to make use of the SOM tools.

3-187. INITIAL SYSTEM STARTUP.

3-188. Initial system startup from an inoperative state is a rare event and would take place after a power outage or other general system shutdown. The Classified System requires some action by the SOM to initiate the pipeline processing of data.

3-189. After the system has been shut off and restarted, the SOM should wait until the system administrator gives assurance that all automatic startup activities have been accomplished.

3-190. INITIATE SOM SESSION.

3-191. To initiate a SOM session, proceed as follows:

a. Login to the SOM station with the user ID som and the password.

b. Select an unused workspace from the Desktop tool bar and select **Launch** from the root menu.

c. Select the popup to start Pipeline Launch.

d. Wait for Pipeline Launch to determine the current host and process status, which may take as much as 30 seconds. At that point:

(1) All host buttons should be colored green.

(2) All process buttons should show a status of Running (green), Stopped (red), or Idle (blue).

e. Wait for Pipeline WorkFlow to appear in its workspace, which may take as much as two minutes.

f. When the Pipeline Workflow appears:

(1) Verify the GUI is updating every 10 seconds by checking the update time (in the upper right corner of the Pipeline Workflow GUI) with the current GMT.

(2) At that point, the station is ready to perform monitoring and control procedures.

3-192. PIPELINE STARTUP PROCEDURE.

3-193. Pipeline startup is performed only if the pipeline is not running when the SOM logs on to the station. The pipeline normally continues to operate whether the SOM is logged on or not, once it has been started.

a. Right-click on the **Isis** button in the Pipeline Launch GUI.

b. Select **Start** and wait for the **Isis** status color to change to green.

c. Right-click on the **dman ops_pipe** button in the Pipeline Launch GUI.

d. Select **Start** and wait for the **dman ops_pipe** status color to change to green.

e. For each of the processing stations (wfsa and pipe1 through pipe8) in the top button bar, use the right mouse button to activate Start-Launchd.

f. Wait until all the machine buttons have turned green.

g. Wait for the status color of both the **dman** and the **agent ops_pipe** process buttons in the Pipeline Launch GUI to change to green.

h. Select **SEIS tis⇒Start**.

i. Select **LFSEIS tis⇒Start**.

j. Select **SPOT tis⇒Start**.

k. Select **HYDR tis⇒Start**.

- - NOTE - -

Allow sufficient time for the tis intervals to process before starting the network processes.

l. Select **NET tin⇒Start**.

m. Select **BNET tin⇒Start**.

n. Select **LFNET ticron⇒Start**.

- - NOTE - -

*In the following step, any Pipeline **Launch** button listed as Unknown means the station the process runs on is not properly operating. Notify maintenance in this case.*

o. Ensure the status color of the above buttons change to green.

p. The **SEIS PM**, **BNET PM, NET PM**, **HYDR PM**, **SPOT PM**, **LFSEIS PM**, and **LFNET PM** buttons should then turn green. This may take as much as 30 seconds.

q. After 15 minutes, verify all Pipeline Launch display detect processes have started.

r. After 30 minutes, verify all the stapro and SEIS processes have started.

s. After 60 minutes, verify all NET processes have started.

t. When each analyst (SEA1, SEA2, and EEA) finishes an analysis interval, verify that the AUT0 processes start within two minutes.

u. The pipeline is now operational. Resume normal operations.

3-194. CATCH-UP PIPELINE PROCESSING.

3-195. The following procedure sets up catch-up pipeline processing of skipped intervals on the basis of start and end times.

a. Select **File⇒Create Intervals/SEIS** from the Pipeline WorkFlow GUI. The Engage popup window will appear.

b. Enter the desired data time for pipeline to begin processing in the **end_time** field of the Engage popup window.

c. Enter the start time of the late data in the **start_time** field.

d. Select NDCS1 (seismic processing network) from the **names** field menu.

e. Select skipped from the **state** field menu.

f. Select **Execute** to create the skipped intervals for seismic stations.

g. Repeat steps a. through f. for the HYDR class, selecting NDCH1 (hydro processing network) in step d.

h. Repeat steps a. through f. for the SPOT class, selecting the spotlight stations in step d.

i. Repeat steps a. through f. for the NET class, selecting NDCS1 in step d.

j. Repeat steps a. through f. for the BNET class, selecting NDCBAR01.

k. Repeat steps a. through f. for the BARM class, selecting NDCBAR01.

l. Repeat steps a. through f. for the LFSEIS class, selecting NDCS1 in step d.

m. Repeat steps a. through f. for the LFNET class, selecting NDCS1 in step d.

3-196. MONITOR THE PIPELINE WORKFLOW GUI.

3-197. Monitor the flow of data through the stages of the processing pipeline by observing the following on the Pipeline Workflow GUI:

a. Availability of near-real-time data.

b. Formation of intervals for automatic processing.

c. Station and network processing stages.

d. First and second stages of seismic analysis.

e. Evaluation stage of seismic analysis.

f. Incorporate late and very late arriving data.

g. Post-analyst processing.

3-198. ANALYST WORK ASSIGNMENT MANAGEMENT.

3-199. Observe analyst work assignment management on the Pipeline WorkFlow GUI as follows:

a. The Pipeline WorkFlow GUI displays which intervals are being worked or have been worked.

b. The state of these intervals is automatically controlled by a link to the analysts' ARS session.

c. When the analyst selects **Latest Interval for AL1**, **Latest Interval for AL2**, **Latest Interval for EVAL1**, **Latest Interval for Hydro**, **Latest Interval for Spotlight (NDCR-KO)**, **Latest Interval for Spotlight (NCR-NZ)**, **Latest Interval for Look-Forward**,

or **Latest Interval for BARAL1** in ARS, an ARS interval of the corresponding type is created and displayed in the WorkFlow for that time period.

d. The state of the interval will be active. When the analyst finishes working the interval and saves it, the state will change to done.

3-200. PRINT REPORTS.

3-201. The SOM root menu item **Reports** prints the following event summaries as needed:

a. **AlertBrief** prints specific information about individual events.

b. **AlertReport** prints more complete information about individual events.

c. **Bulletin** prints a seismic bulletin with event and detection information for a time period.

d. **EventList** produces a time-ordered display of all the events in a database account in the specified time period.

e. **Retrieve Triple Location** produces a time-ordered display of all the origins in a database account.

3-202. To produce any of the five types of reports, perform the following procedure:

a. Select **Reports** from the root menu.

b. Select the desired report type when the report type menu appears.

c. When the Engage window appears, type in the required parameters or select from lists using the list icons.

d. Select the **OK** button.

3-203. MONITOR DATA ARCHIVING.

3-204. All archiving functions are covered in section I.

3-205. INTERVAL OPERATIONS.

3-206. Processing of intervals is controlled from the Pipeline WorkFlow GUI by right-clicking in an interval brick or by using the **File** menu.

a. Operations applicable to single intervals are normally controlled by clicking in the interval brick.

b. Operations applicable to multiple intervals, either across time periods or across stations are done using the popup window obtained from the **File** menu.

3-207. CREATE NEW INTERVALS.

3-208. To create new intervals, proceed as follows:

a. Select **Create Intervals** from the Pipeline Workflow **File** menu. The Create Intervals popup window will appear.

b. Click on the **Name** icon and select the required name from the pull-down menu.

c. Click on the **Start Time** icon and select the required start time from the pull-down menu.

d. Click on the **End Time** icon and select the required end time from the pull-down menu.

e. Click on the **State** icon and select the required state from the pull-down menu.

f. Click on the **Size of Interval** icon and select the required interval size from the pull-down menu.

g. Select **Execute**.

3-209. CHANGING INTERVAL STATES.

3-210. The processing performed on an interval is controlled by the state of the interval at the current time. Thus, to alter the normal sequence of processing, or to reprocess an interval, the method is to change the current state of the interval.

3-211. CHANGING THE STATE OF A SINGLE INTERVAL. To change the state of a single interval, proceed as follows:

a. Select **Edit Interval** from the interval menu by clicking the right mouse button on the interval brick in the main WorkFlow GUI.

b. Enter the desired parameters in the **Edit Interval** dialog box when it appears.

c. Select **OK**.

3-212. CHANGING THE STATE OF MULTIPLE INTERVALS. To change the state of multiple intervals, proceed as follows:

a. Select **File⇒Change Intervals State** from the Pipeline Workflow Window. The Change Intervals State popup window will appear.

b. Click on the **Name** icon and select the required name from the pull-down menu.

c. Click on the **Start Time** icon and select the required start time from the pull-down menu.

d. Click on the **End Time** icon and select the required end time from the pull-down menu.

e. Click on the **State** icon and select the required state from the pull-down menu.

f. Click on the **New State** icon and select the required new state from the pull-down menu.

g. Select **Execute**.

3-213. Intervals can be processed manually. Most often this will occur when late-arriving data make it desirable to reprocess the interval, but other situations can occur. Possible problems include loss of a machine, loss of power or some other system or database failure. Affected intervals can be reprocessed when the problem has been solved. Intervals may be processed singly (paragraph 3-214) or in groups (paragraph 3-215).

3-214. SINGLE INTERVAL. The procedure to process a single interval using the Pipeline WorkFlow GUI is as follows:

a. Right-click in the desired WorkFlow interval.

b. Select **Process Interval** from the interval menu.

c. Check the interval for errors when processing is complete.

3-215. MULTIPLE INTERVALS. The procedure for processing multiple intervals is as follows:

a. Select **File⇒Process Intervals/<Ptype>** where **<Ptype>** is one of the auto processing types.

b. When the dialog box appears, fill in the required data or select from the lists using the right mouse button in the list icon.

c. Check the success of the processing when complete. If multiple stages of processing were involved, such as station intervals followed by network intervals with a sleep time, check the progress of the later stages when done.

3-216. CHECK EXCEPTION INTERVALS IN EXCEPTION LIST.

3-217. The following procedure raises the exception list and guides the SOM operator in assessing problems:

a. Select **View⇒Exception** in the WorkFlow GUI.

b. Scroll through the list of exceptions to find the interval of interest.

c. Right-click in the desired interval.

d. Bring up the **Monitor** windows for each interval in turn from top to bottom.

e. Locate the first process with a completion message indicating an error.

f. Examine the log output above the completion message to determine the cause of the problem.

g. Assess the cause of the problem to determine a possible solution.

3-218. REQUESTING LATE WAVEFORM DATA.

3-219. Late waveform data will be processed automatically through station processing whenever it is received on the classified side. Requests for late data are made by the DAM on the unclassified Data Acquisition subsystem. The data, when received, will be sent through the Secure Diode to the Classified System.

3-220. CHECK MAIL.

3-221. Periodically check the mailbox for any message sent by processes. Some processes notify the mailbox when successfully completed, while others only send messages on errors. EventWarning sends an audible notification when it issues a mail message.

3-222. PIPELINE MONITORING PROCEDURES.

3-223. The automatic pipeline processes require operator intervention only when an error or data condition causes a temporary failure to occur. The conditions causing errors may include hardware, software, database, or data acquisition problems. The principle tools available to monitor the automatic processing are the Pipeline WorkFlow GUI, which tracks the status of data intervals, and the Pipeline Launch display, which tracks the status of processes and machines. Supplementary information is available in the processing logs,

which are generally retained for at least 30 days. Current logs may be examined with the Pipeline WorkFlow GUI. Logs made before the current date can be examined with an editor.

3-224. PIPELINE LAUNCH.

3-225. The Pipeline Launch GUI provides a quick check of the health of the processing system. Processors and processes that are red indicate a problem which needs to be investigated.

3-226. PIPELINE WORKFLOW GUI.

3-227. The Pipeline WorkFlow GUI provides a quick check of the state of the data. Red bricks represent failed intervals. At any point in time probably at least one brick will be yellow to signify a process is running. In normal operations, the Pipeline WorkFlow bricks should be turning from blue to yellow to green. Other colors mark exceptional circumstances which should be analyzed.

3-228. MANUAL PROCESSING.

3-229. Once an interval has been created or an interval has failed in one of the processes associated with it and the problem fixed, most process intervals can be manually reprocessed using the Pipeline WorkFlow GUI popup menus.

3-230. MONITOR PROCESSING LOGS.

3-231. Each of the bricks in the Pipeline WorkFlow GUI and most of the processes in Pipeline Launch produce logfiles which can be examined at any time. Periodic monitoring of the logs will keep the SOM informed of the state of the system and data. Individual logs may be examined using an editor or one of the UNIX functions cat or more. Logs produced by pipeline processing are located in the `/data/wfsa/log/pipeline` directory. Logs for the receiving side of the Secure Diode Link are located in the `/data/wfsa/log/diode` directory.

3-232. LATE WAVEFORM DATA OPERATIONS.

3-233. Waveform data is called late if it arrives too late to be included in station processing before network processing has been initiated for the interval containing the late data. The US NDC handles most instances of late-arriving data automatically without any action from the SOM.

3-234. Late data falls into three categories:

a. Late Data. Data expected in near real-time which has been delayed by communications or field site problems long enough to miss regularly scheduled network processing, but in time to be worked within an analyst or evaluator interval.

b. Very Late Data. Data that arrives after the EEA stage for the data time interval.

c. Alphanumeric data from outside sources which is always received significantly behind real-time due to the processing time involved (refer to paragraph 3-243).

3-235. LATE DATA.

3-236. Recognition of late data in the Pipeline WorkFlow GUI is as follows:

a. First an interval will be colored gray. This means it was skipped because the data was not available when the next data interval was received.

b. When the data is received, station processing is automatically begun, and the interval turns yellow.

c. When station processing is complete, the interval turns light green and the state becomes station-done.

d. The destination of the data then depends on how far behind the data is. If the station processing is completed before one of the analysis intervals has begun for the time period, the data is automatically passed to that analysis session as unassociated data. The data is passed to the earliest possible analysis stage that has not yet begun.

e. When this happens, the data interval turns dark green, and is labeled with the state al1, al2, or eval1, as appropriate, to show when the data was worked. If the station processing on the late data interval is not completed until the EEA stage is completed, the data becomes very late data.

3-237. VERY LATE DATA.

3-238. The term very late data refers to data received and subjected to detection processing after evaluation has finished for the corresponding time interval. If the data finishes station processing after the evaluators have finished with the data interval, the SOM has two choices. Either the analysis of the interval can be repeated, or the data can be archived without analysis. If the analysis is repeated, the very late data will be presented to the EEA session as unassociated data and can be analyzed and used as appropriate. In this case, the station brick will turn dark green when the Eval1 interval is saved and be in state eval1-done.

3-239. EVENT DATA FROM DETACHMENT 460.

3-240. If the mission is transferred temporarily to Detachment 460, the analysts there report data for area of interest (AOI) events, if any. The data is currently reported by telephone. Such data can be inserted into the classified database using the SQL*Plus interface. Consult with the database administrator or other operator experienced in SQL*Plus, if needed, to accomplish this. If the data can be recovered after an outage of only a few hours, it may not be necessary to put the data into the database, but rather rely on normal pipeline processing.

3-241. MIGRATE DATA.

3-242. MigrateData is used to move data from the operational database to the archive database. It is run as a cron job, automatically archiving the alphanumeric data from all operational database accounts. No operator intervention is required.

3-243. ALPHANUMERIC DATA FROM EXTERNAL SOURCES.

3-244. Certain external sites send alphanumeric arrival data via wide area network (WAN) to the US NDC. This arrival data results from observations by analysts at the external sites. The arrival messages are sent directly to the US NDC where they are automatically processed into the system. The messages usually arrive several hours behind real-time. Pipeline WorkFlow GUI intervals are created for each message type and the intervals can be selected to view the log for the message processing. If the automated processing finds a problem with the format of the data, the Pipeline WorkFlow GUI interval will be marked failed.

3-245. 06X ALPHANUMERIC DATA. The 06X sites send arrival data by means of the classified WAN. A sample data message is shown in figure 3-33.

3-246. EXAMPLE 06X MESSAGE ERROR. An example of an error message (seen in the log accessed from the Pipeline WorkFlow GUI) that might occur in the processing of an 06X message line containing a syntax error such as the following line (which contains an E. instead of a C.):

```
‘CM 0317544 E.SPZ M.0025 P.012’
```

is the following error message:

```
‘ERROR: Channel ID token does not start with C. at line 45.’
```

3-247. CORRECTING 06X MESSAGE ERRORS. Edit the message file indicated in the processing log, save it, and process the interval as if it had just arrived:

a. Run vi in an xterm window by typing:

```
% vi <path>/mail.#.#
```

b. Correct the errors found at the line numbers indicated in the processing log.

c. Save the file and exit the vi editor.

d. Select **Process** from the interval menu in the Pipeline WorkFlow GUI.

```
OCAEZYUW RUAGDNAO442 0401543-EEEE--RUDGAAA.

ZNY EEEEE

O 010618Z FEB 95

FM DET 452 WONJU KOR//DOS//

TO RUDGAAA/HQ AFTAC PATRICK AFB FL//DONNA//

BT

UNCLASS E F T O

PART ONE

//// 95 01 31

KS 1222287 EP C.SPZ M.0014 P.006 T.T

KS 1232495 EP C.SPZ M.0018 P.008 T.T

KS 1233050 E C.SPZ M.0016 P.007 T.T

KS 1252378 EP C.SPZ M.0008 P.005 T.T

KS 1252476 E C.SPZ M.0024 P.005 T.T

KS 1311057 EP C.SPZ M.0062 P.004 T.T

KS 1312157 E C.SPZ M.0030 P.011 T.T
```

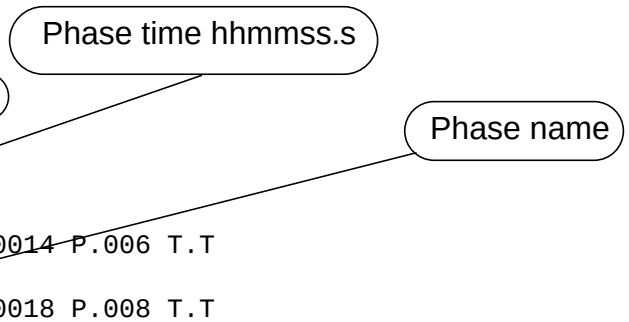

Figure 3-33. Example Data Message

3-248. DATA FROM INTERNET SOURCES. Alphanumeric data, consisting of arrival times, phase names, periods, and amplitudes is sent to the US NDC by means of the public Internet. Currently arrival data is received from the NEIC and from Norway. This data, which normally arrive two to four hours behind real-time, is interpretations made by analysts at the contributing sites used to improve seismic event location by broadening geographic coverage.

3-249. OFF-LINE DATA TRANSFER FROM MEDIA. Data to be transferred from magnetic media will be recorded in CS 3.0 format as tar files on 8mm tapes. The tar files must have the following structure, which is parallel to the US NDC waveform data structure. Any other format will require special treatment by the system administrators or the system developers:

```
/1999/
/1999/ddd/
/1999/ddd/000000
/1999/ddd/020000
```

3-250. Waveform data and the accompanying wfdisc files need to be loaded to a directory from which they can be processed into the database. The procedure is as follows:

a. Locate a classified host with the appropriate tape drive.

b. Insert the tape into the 8mm tape device on sysadmin.

c. Login as a member of the data group to the host where the tape has been loaded:

% **rsh <hostname>**

d. Move to the special directory set aside for import of data from tape:

% **cd /data/wfsa/data3/tape_data**

e. Issue the following command to verify the contents of the data tape:

% **tar tf /dev/rmt/0**

f. If the file structure appears correct as described in 3-249, extract the data from tape using the following command:

% **tar xvf /dev/rmt**

g. Examine the files with the filename tag `.wfdisc` among the files just extracted.

h. If necessary, correct the path in the wfdisc files to point to the current directory structure. Ask for assistance from system administration, if needed. This process may require creation of a sed script to edit multiple lines in multiple files.

i. Run the load_wfdisc program to insert the wfdiscs into the database:

% **load_wfdisc** (program will prompt for parameters if needed)

j. Delete the `<filename>.tar` file from the `/data/wfsa/data3/tape` directory:

% **rm <filename>.tar**

3-251. ALERTS AND BULLETINS.

3-252. Software tools are available to produce various event summaries as needed.

a. **AlertBrief** and **AlertReport** print specific information about individual events. A FrameMaker formatted document can be edited and printed.

b. **Bulletin** prints a seismic bulletin with event and detection information for a time period. The bulletin can be printed.

c. **EventList** produces a display of all the events in a time period. The event list can be printed.

d. **Retrieve Triple Location** produces a time-ordered display of all the origins in a database account.

3-253. ALERT BRIEF.

a. Select **Root⇒Reports⇒AlertBrief**.

b. Fill in the orid and account.

c. Select **Execute**.

d. Open the file listed in the message section of the AlertBrief window using FrameMaker

e. Print the report using FrameMaker if desired.

3-254. ALERT REPORT.

a. Select **Root⇒Reports⇒AlertReport**.

b. Fill in the orid and database in the Engage window.

c. Select **Execute**.

d. Open the file listed in the message section of the AlertBrief window using FrameMaker.

e. Edit or add information as needed.

f. Print the report using FrameMaker if desired.

3-255. BULLETIN.

a. Select **Root⇒Reports⇒Bulletin**.

b. Fill in the blanks for the account and time interval desired or use the list icons.

c. Select **Execute** to produce the bulletin.

d. Select **Print** if a printed copy is desired.

3-256. EVENT LIST.

a. Select **Root⇒Reports⇒EventList**.

b. Fill in the blanks for the account and time interval desired or use the list icons.

c. Select **Execute** to produce the event list.

d. Select **Print** if a printed copy is desired.

3-257. RETRIEVE TRIPLE LOCATION.

a. Select **Root⇒Report⇒Retrieve Triple Location**.

b. Fill in the blanks for the account and time interval desired, or use the list icons.

c. Select **Execute** to produce the origin list.

d. Select **Print** if a printed copy is desired.

3-258. EVENT WARNING.

3-259. If the Look-Forward process detects a possible event candidate in one of the target areas, it will issue an e-mail message to the SOM with the location and origin time estimate. An audible alarm will be issued to obtain timely attention to the email.

3-260. EVENT WARNING PROCEDURE.

3-261. If an event warning notification occurs, the SOM should follow the steps:

a. Bring up the desktop Mail tool on the SOM station.

b. Read the EventWarning message, determining the location and origin time.

c. Make a decision about the priority of the warning.

d. If the warning has high priority, direct an analyst to open a data window beginning 30 minutes or more before the event origin time, and analyze the event based on the available data.

e. Based on the analysis of the event, take other appropriate action.

3-262. SWARM CONDITIONS.

3-263. No special processing is required in the case of earthquake swarms of any previously experienced extent.

3-264. CLASSIFIED SYSTEM SHUTDOWN PROCEDURES.

3-265. The US NDC system operates continuously. Therefore, shutdown of the entire Classified System is an unusual event caused by abnormal conditions, such as hardware maintenance, unexpected or expected loss of electrical power, or other emergency. If a shutdown is needed, it should be performed by the system maintenance personnel, if possible.

3-266. GRACEFUL PIPELINE SHUTDOWN.

3-267. Normally the pipelines operate continuously. The expected circumstances in which the Pipeline Processing would be shut down on a non-emergency basis are:

a. System reconfiguration, including switch over between the A and B systems.

b. Planned downtime, such as a hurricane evacuation or planned power outage.

c. Other shutdown with at least 30 minutes advance notice.

3-268. Soft or graceful shutdown of equipment is to be performed if possible to promote data integrity when the system is restarted. An emergency shutdown of equipment should be avoided in favor of an orderly shutdown if at all possible for the following reasons:

a. Restoration of mission capability typically requires 30 minutes or more.

b. Some data files may become lost or corrupted, further impairing return to normal operations.

3-269. In order to accomplish a pipeline shutdown on a non-emergency basis, perform the following steps after logging on with the SOM password at a classified SOM station:

a. Using the Pipeline Launch GUI, stop all the tis process types (SEIS tis, LFSEIS tis, SEIS tis part, SEIS tis late, SPOT tis, SPOT tis part, SPOT tis late, BARM tis, BARM tis part, BARM tis late, HYDR tis, HYDR tis part, and HYDR tis late) by right-clicking on **Stop** in the corresponding process bricks.

b. Direct all analysts and evaluators to save their intervals and quit. If enough time is available, direct the analysts and evaluators to complete the current analysis interval. If not, proceed to the next step.

c. Direct all analysts and evaluators to save their intervals and log off.

d. Wait until all running processes have stopped. This takes a maximum of 15 minutes after the last analyst has logged off.

e. At this point, the Pipeline is effectively shut down. Stopping the pipeline processors is optional. This may be done by right-clicking on **Stop Launchd** in the eight machine buttons in the Pipeline Launch display. Consult with maintenance personnel as to the need to perform this step.

f. Notify maintenance personnel that the Pipeline has been shut down. Maintenance personnel will normally carry out the necessary system shutdown and power-off procedures after the Pipeline has been shut down.

3-270. PIPELINE PROCESSOR FAILURE.

3-271. The Pipeline can be reconfigured through Pipeline Launch to use an alternate machine to replace a pipeline processing machine. This is needed when the processing machine needs a repair which will take much longer than a few minutes. Thus, rebooting the processor will not require a replacement, but any other action will probably take enough time to degrade the Pipeline processing. Always consult maintenance personnel before starting the following process. If it becomes necessary, perform the following procedure steps in cooperation with maintenance personnel to failover a Pipeline processing machine.

3-272. SWITCH OUT PROCESSOR.

a. Select **dman ops_pipe⇒Stop**.

b. The machine is still operational, select **Stop** from the menu of process buttons for tis-type processes on that machine.

c. If the machine is still operational, select **Stop** from the menu of process buttons for all remaining processes on that machine. If possible, allow any currently queued or active processing to complete before stopping the processes.

d. Request that maintenance personnel modify the `$HOME/.dt/dtwmrc` file to switch processors. This involves inserting a parameter pipe1=pipealt (e.g., to replace pipe1a) into the proper line of the Pipeline Launch Menu section. Proceed after the file has been modified and saved.

e. Select **Restart Workspace Manager** from the root menu.

f. Start a second Pipeline Launch interface from the root menu in the same manner that the first Launch interface was started. The new Launch GUI will not show the processor which was replaced. Normally wfs will take the processor load.

g. In the Pipeline WorkFlow GUI, select **Process** from the menu of any failed or inactive intervals associated with the machine which was substituted.

h. Select **Start** from the menu of the **dman ops_pipe** process button in the second Pipeline Launch GUI.

i. Select **Start** from the menu of the process buttons of any tis- or tin-type processes which run on the new pipeline machine in the second Pipeline Launch GUI.

j. When the second Launch interface appears to be functioning properly, exit the first Pipeline Launch interface. Notify maintenance personnel if the second Launch does not indicate proper operation.

3-273. EXPORTING DATA FROM THE US NDC TO TAPE FOR IMPORT ONTO THE TRAINING SYSTEM.

3-274. Data is exported from the US NDC to data tapes for import onto the Training System. Each tape will hold approximately seven days of data. When choosing the start and end times, make sure that it will fit on the tape.

a. Coordinate with Database Administration personnel to ensure that the tape drive for the machine cdbsa is available for use.

b. Place tape into the external tape drive attached to the Pipeline DB Server.

c. From the SOM workstation, login to Pipeline DB Server.

- - NOTE - -

Single time intervals and multiple time intervals can be exported by running TrainingExport from the command line (steps e through g). If only a single time interval is needed, the TrainingExport GUI can be used (steps d, f, and g).

d. To export one time interval, bring up the TrainingExport GUI by typing:

```
Engage TrainingExport
```

(1) Right-click on the Start time icon to choose the start time then righ-click on the End time icon to choose the end time.

(2) Select the **Execute** button.

(3) When the process has completed, select the **Close** button and proceed to step f.

e. To export multiple time intervals, the TrainingExport script must be run from the command line. The start-time and end-time are passed into the script and need to be in epoch time. Use htoe to convert the start-time and end-time to epoch time.

(1) Compute the epoch time for start-time:

`htoe <start-time>` (Where the start-time is in the format mm/dd/yyyy hh:mm:ss)

(2) Repeat for each interval.

(3) Compute the epoch time for the end-time.

`htoe <end-time>` (Where the end-time is in the format mm/dd/yyyy hh:mm:ss)

(4) Repeat for each interval.

- - NOTE - -

In the following step, **`[,<epoch>]`** *indicates additional start and end times may be added if necessary.*

(5) Run the TrainingExport script:

```
TrainingExport start-time=<epoch>[,<epoch>] end-time=<epoch>
[,<epoch>] par=/usndc/ops/config/DACS/training/TrainingExport.par
```

f. Remove the data tape from the external tape drive.

g. Notify Database Administration personnel that the tape drive is now available for use.

3-275. CHECK SYSTEM TIME AND DATE.

3-276. All machines in the Classified System must have the same system clock time. Processing failures will likely occur if the time is allowed to deviate on any given machine. A root-owned process called ntpd, running on each machine, periodically synchronizes the system clock with the time on other machines. A routine check is needed to verify that this synchronization is occurring properly. Compare the system times of Classified System machines with those of the SOM station as follows:

a. At an xterm command prompt enter the following:

```
foreach mach(wfsa carch cdbsa pipe1a pipe2a pipe3a pipe4a pipe5a
pipe6a pipe7a pipe8a)
echo 'hostname:'$mach; rsh $mach date; date
end
```

b. Examine all the outputs of this script. They should be similar to the following example:

```
hostname:wfsa <----- Processor being polled
Tue Jul 27 21:12:24 GMT 1999 <----- Host time value
Tue Jul 27 21:12:24 GMT 1999 <----- SOM host time value
hostname:carch <----- Processor being polled
Tue Jul 27 21:12:25 GMT 1999 <----- Host time value
Tue Jul 27 21:12:25 GMT 1999 <----- SOM host time value
```

c. If the date/time returned by each loop for a given machine is separated by more than a few seconds from the host time, then refer the problem to System Administration.

SECTION III

ANALYST/EVALUATOR STATION

3-277. GENERAL.

3-278. The Analyst/Evaluator Station performs interactive analysis of the seismic and hydroacoustic data acquired by the US NDC. The purpose of interactive analysis is to provide the user with the capability to display/review and refine/correct currently available results whether they be the product/output of an automatic processing pipeline, or a previous stage of interactive analysis. The Analyst Review Station (ARS), Discrim, and Hydrodisplay Tool (HDT) are the central components of the interactive analysis software suite. ARS allows the analyst to view and manipulate parametric and waveform data as well as provide access to various tools for signal processing, mapping, event location, magnitude estimation, automatic association, and event classification. The tools invoked to accomplish these numerous tasks are, in almost all cases, the same algorithms used during automatic processing. The Discrim and HDTs provide the capability to review and modify event identification/classification results for seismic and hydroacoustic observations, respectively.

3-279. This section presents the steps involved in the analyst operating procedures for the global pipeline which currently includes both seismic and hydroacoustic data.

3-280. CONTROLS AND INDICATORS.

3-281. This section provides an overview of the controls and indicators and GUIs the analyst will encounter during an interactive processing session.

3-282. ROOT MENU.

3-283. The root menu pops up when the operator clicks any mouse button in the background area of one of the desktops on the station. The root menu provides access to most of the commonly used operator functions. The appearance of the root menu and all its submenus is shown in figure 3-34. The main menu items are:

a. **New Window**. Opens a new x-term window in the current workspace.

b. **WorkFlow**. Brings up the pipeline workflow window. Evaluators only.

c. **Process Orid**. Brings up an engage window to process a single origin.

d. **Editors**. Produces a list of the available editors: emacs, Xemacs, Text Editor, and FrameMaker.

e. **Reports**. Produces listings or standard reports from the database: Bulletin, EventList, Alert Brief, Alert Report or Retrieve Triple Location.

f. **Utilities**. Produces a list of utility functions: Calculator, Man Pages, News, Audio Tool, Image Viewer, Performance Meter, Calendar Manager, GMT Clock, File Manager, Snapshot, and Print Window.

g. **Refresh**. Refreshes screen display.

h. **Restart Workspace Manager**. Restarts the program manager without logging the user out or killing any processes. This is primarily needed to update the root menu after editing `$home/.dt/dtwmrc`.

i. **Minimize/Restore Front Panel**. Iconifies or expands the panel tool at the bottom of the screen.

j. **Exit Session**. Logs the user out and stops all processes started by SOM in that session on the local host. Data transfer processes already running continue running. A verification window will come up before executing the command.

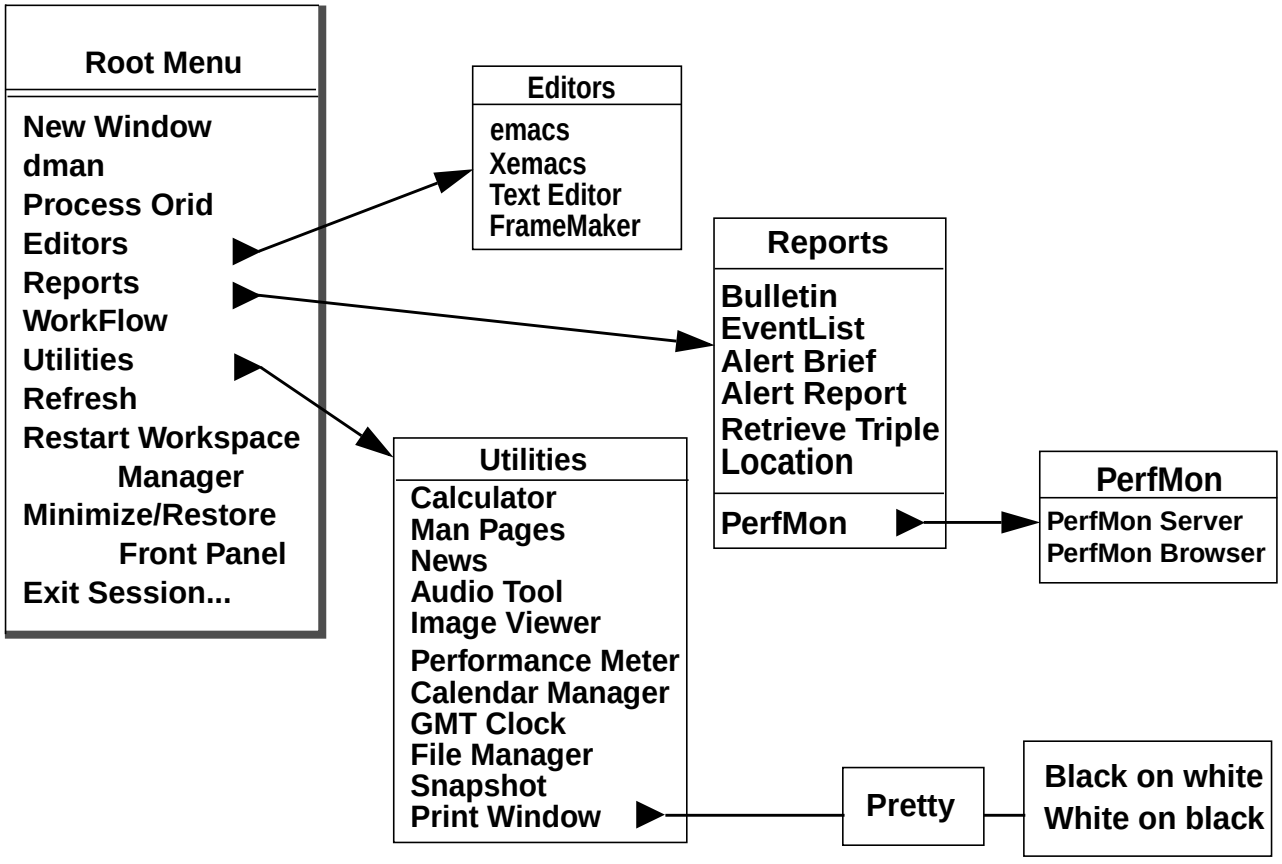

Figure 3-34. Root Menu

3-284. DMAN.

3-285. DACS Manager (dman) provides a tool that allows the analyst to monitor and control components of the DACS. Dman provides menus and options (figure 3-35) that allow the analyst to start/launch and stop/kill interactive processing tools, communicate with the Interprocess Communication (IPC) agent responsible for managing messages passed between processes, and configure the message area that displays run-time status messages.

a. The **Programs** menu provides the following selections:

(1) **Launch**. Pops up the Launch dialog to launch additional processes.

(2) **Kill**. Pops up the Kill Program dialog.

(3) **Kill All**. Pops up a confirm dialog before killing all connected processes.

(4) **Exit**. Closes dman after confirmation.

b. The **Connections** menu provides the following selections:

(1) **Connect to agent**. Pops up the Connection Dialog.

(2) **Disconnect**. Disconnects dman from the Agent.

(3) **Re-acquire Connections**. Restores lost connections.

c. The **Options** menu provides the following selections:

(1) **Message scroll off**. Turns off scrolling in the message window.

(2) **Message scroll on**. Turns on scrolling in the message window.

(3) **Message Purge**. Clears the message window (except for the purge message).

(4) **Load Scheme File**. Pops up a dialog prompting for a scheme file to load.

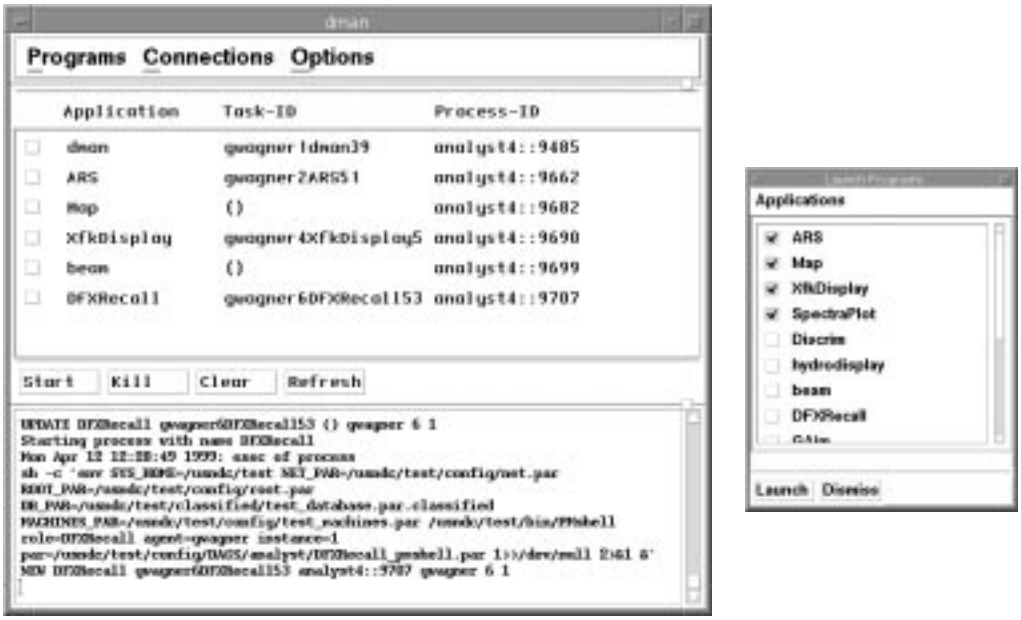

Figure 3-35. dman Windows

3-286. ARS.

3-287. ARS is the central component for detailed interactive analysis. ARS (figure 3-36) provides an interface which allows the analyst to display/review and refine/correct results from automated processing and/or previous stages of interactive analysis, and invoke tools for signal processing, event location and magnitude estimation, automatic association, mapping, and event classification.

a. The **File** menu provides the following selections:

(1) The **Open** submenu provides the following selections:

(a) **Latest Interval for AL1**. Pops up the time interval selection dialog with the default interval for AL1.

(b) **Latest Interval for AL2**. Pops up the time interval selection dialog with the default interval for AL2.

(c) **Latest Interval for EVAL1**. Pops up the time interval selection dialog with the default interval for EVAL1.

(d) **Latest Interval for EVAL2**. Pops up the time interval selection dialog with the default interval for EVAL2.

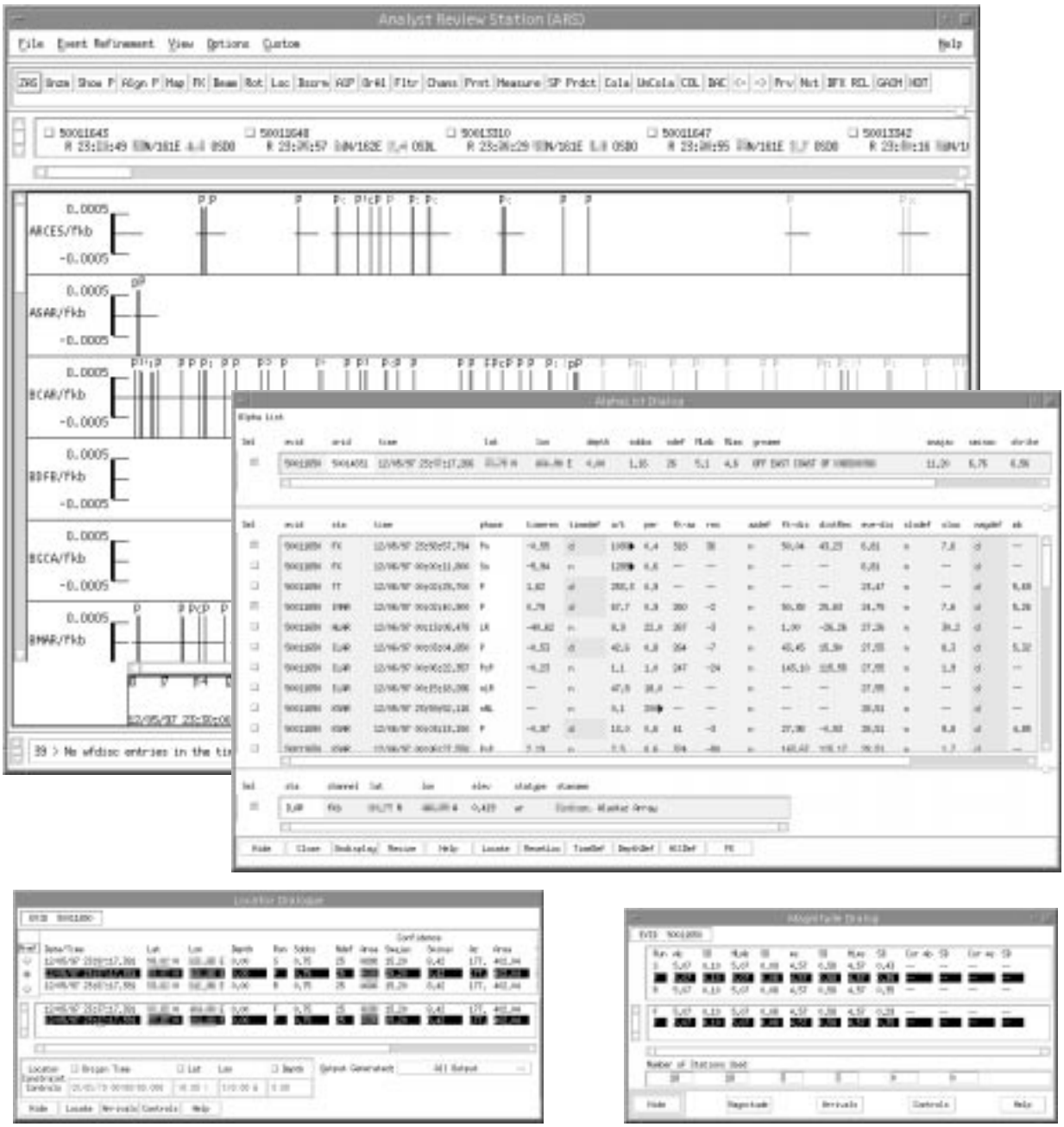

Figure 3-36. Primary ARS Windows: The Main ARS Display, AlphaList, Locator, and Magnitude Dialogs

(e) **Latest Interval for Hydro**. Pops up the time interval selection dialog with the default interval for hydroacoustic data.

(f) **Latest Interval for Spotlight (station)**. Pops up the time interval selection dialog with the default interval for Spotlight for the listed station.

(g) **Latest Interval for Look-Forward**. Pops up the time interval selection dialog with the default interval for Look-Forward.

(h) **Latest Interval for BARAL1**. Pops up the time interval selection dialog with the default interval for BARAL1.

(i) **Open Anything**. Pops up the interval selection dialog for selecting arbitrary intervals, databases, or networks.

(j) **Open Recovery File**. Pops up the data recovery dialog to restart ARS from the most recent session recovery file.

(2) The **Save** submenu provides the following selections:

(a) **Save Single Origin.** Saves a single origin.

(b) **Save Data.** Saves data.

(c) **Save Selected Beams.** Saves selected beams.

(d) **Save Window.** Saves window.

b. The **Event Refinement** menu provides the following selections:

(1) The **Origin** submenu provides the following selections:

(a) **Add Origin**. Creates a new origin and displays it in the origin bar.

(b) **Unfreeze Origins**. Unfreezes selected origins so they can be modified.

(c) **Delete Origin**. Deletes selected origins.

(2) The **Arrival** submenu provides the following selections:

(a) **Add Arrival**. Pops up the phase names dialog to select a phase name.

(b) **Add with Current Phase**. Adds a new arrival with the last selected phase name.

(c) **Add P Arrival.** Adds P Arrival at the t1 time on the selected channel.

(d) **Delete Arrivals**. Deletes selected arrivals after confirmation.

(e) **Rename Arrivals**. Pops up the Phase names dialog to rename an arrival.

(f) **Rename to Current Phase**. Renames the selected arrival to the last selected phase name.

(g) **Retime Arrival**. Retimes the selected arrival to the t1 time.

(h) **Nullify Arrival**. Removes all attributes from an arrival.

(i) **Unfreeze Arrivals**. Unfreezes selected arrivals.

(j) **Add LQ Arrival**. Adds a Love (LQ) Arrival at the t1 time on the selected channel.

(k) **Add LR Arrival**. Adds a Rayleigh (LR) Arrival at the t1 time on the selected channel.

(l) **Add pP Arrival**. Adds a p Arrival at the t1 time on the selected channel.

(3) The **Alpha List** submenu provides the following selections:

(a) All **Arrivals in View**. Sends all arrivals in the window to the alphalist.

(b) All **Unassoc in View**. Sends all unassociated arrivals in the window to the alphalist.

(c) Any **User Selection**. Sends any selected arrivals or origins to the alphalist.

(d) **Associate**. Associate selected arrivals to the selected origin.

(e) **Disassociate**. Disassociate selected arrivals from any origin.

(f) **Locate**. Locate the selected origin.

(4) The **Locator Options** submenu provides the following selections:

(a) **Set Locator Iterations**. Pops up the locator iterations dialog.

(b) **Reset Locator**. Resets the seed location for Locator to 0.0,0.0.

(5) The **Remarks** submenu provides the following selections:

(a) **Add Remarks to all selected**. Adds remarks to all selected arrivals or origins.

(b) **Edit Remarks for single object**. Allows editing of remarks for a selected arrival or origin.

(c) **View Remarks for all selected**. Displays the remarks for all selected origins or arrivals.

(d) **Add Remarks to frozen object**. Allows remarks to be added to a frozen object without unfreezing it.

c. The **View** menu provides the following selections:

(1) The **Filter** submenu provides the following selections:

(a) **Default Filters**. Apply default filters to all displayed channels.

(b) **Unfilter**. Remove filters from all channels.

(c) **Match ASN Channels**. Apply a filter to make AFTAC Southern Network (ASN) channels look like normal short period (SP) channels.

(d) **Add Single Filter to List**. Pops up the Single Filter Design dialog.

(e) **Add Cascade Filter**. Pops up the Cascade Filter Design dialog.

(f) **Edit Filter List**. Pops up the Filter List dialog.

(g) **Toggle Default Filters**. Toggles default filters on or off.

(h) **Toggle LP Filters**. Toggles default filters on or off on long period (LP) channels.

(i) **Toggle Measurement Filters**. Toggles default filters on or off.

(2) The **Expand** submenu provides the following selections:

(a) **Expand Station**. Displays all raw data channels (SP or LP) for a station.

(b) **Unexpand Station**. Returns to the beam channels only for a station.

(3) The **Later Phases** submenu provides the following selections:

(a) **SP Phases**. Zooms to a six-minute window centered on the initial arrival for the selected origin, with all theoreticals predicted. The display is compressed vertically.

(b) **LP Phases**. Zooms to a 40-minute window centered on the predicted LR arrival for the selected origin.

(c) **Return**. Returns to the most recent normal SP display from the LP display.

(4) The **Align Channels** submenu provides the following selections:

(a) **Align Theoretical**. Pops up the Phase dialog to set the current phase.

(b) **Align Theoretical with Current Phase**. Aligns theoretical channels with phase.

(c) **Align Designated**. Pops up the Phase dialog and aligns designated channels on that phase.

(d) **Align Designated with Current Phase**. Aligns designated channels on the current phase.

(e) **Unalign**. Unaligns all channels and returns to real-time basis.

(5) **Isolate Waveforms for Arrivals.** Displays only waveforms associated with the selected origin when multiple beams are shown.

(6) The **Zoom View** submenu provides the following selections:

(a) **Zoom**. Zooms the display to the time interval bounded by the t1 and t2 markers.

(b) **Zoom on Arrival**. Zooms to a 60-second window centered on the selected arrival.

(c) **Zoom on Origin**. Zooms to a five-minute interval beginning about one minute before the initial arrival on each channel.

(7) The **Unzoom View** submenu provides the following selections:

(a) **Expand Window** pops up the **Set Expand Factor** submenu which provides for selections factors of **10**, **5**, **3**, and **1.5**.

(b) **Undo Zoom**. Reverts to the previous zoom level.

(c) **Unzoom All**. Reverts to the full two-hour window and removes waveforms.

(8) The **Sort** submenu provides the following selections:

(a) **Sort by Distance**. Sorts by distance.

(b) **Sort by User**. Sorts by user.

(c) **Sort by Chan/Distance**. Sorts by Chan/Distance.

(d) **Compress Display**. Compresses display.

(e) **Kill selected channels**. Removes selected channels from the display.

(f) **Default Sort**. Sorts channels alphabetically.

(9) The **Predicted Arrivals** submenu provides the following selections:

(a) **Show User Selected Predicted**.

(b) **Show Previous Selected Predicted**.

(c) **Remove Predicted Arrivals**.

(d) **All Predicted Arrivals**.

(e) **Selected Channels Only**.

(10) **Show Default Channels for Origin**.

(11) **Final Look**. Check origin.

d. The **Options** menu provides the following selections:

(1) The **Amp/Period Boxes** submenu provides the following selections:

(a) **Show for Initial Arrivals**. Shows measure boxes for initial arrivals associated with the selected origin.

(b) **Unshow for Initial Arrivals**. Turns off measure boxes for initial arrivals associated with the selected origin.

(c) **Show for Assoc Arrivals**. Shows measure boxes for all arrivals associated with the selected origin.

(d) **Show for Selected Arrivals**. Shows measure boxes for selected arrivals.

(e) **Unshow for Selected Arrivals**. Turns off measure boxes for selected arrivals.

(2) The **Display Clutter** submenu provides the following selections:

(a) **Clutter On**. Turns on previously selected display options (e.g., filter parameters, scale types).

(b) **Clutter Off**. Turns off display options (e.g., filter parameters, scale types).

(3) The **Waveforms** options submenu provides the following selections:

(a) **Waveforms On**. Turns on waveforms.

(b) **Waveforms Off**. Turns off waveforms (flat-line display).

(4) The **Phase Labels** options submenu provides the following selections:

(a) **Labels On**. Turns on arrival phase labels.

(b) **Labels Off**. Turns off arrival phase labels.

(5) The **Arrival Bars** submenu provides the following selections:

(a) **Bars On**. Sets full-height arrival onset bars on.

(b) **Bars Off**. Turns arrival onset bars off.

(c) **Full Height Bars**. Sets the arrival bars to full-height.

(d) **SNR Sized Bars**. Sets the height of arrival bars to a height based on the signal-to-noise ratio (SNR).

(6) The **Filter Parameters** submenu provides the following selections:

(a) **Filter Parameters On**. Displays the filter parameters from each channel.

(b) **Filter Parameters Off**. Removes the filter parameters on all channels.

(7) The **Scale Types** options submenu provides the following selections:

(a) **Scale Types On**. Turns on a channel label showing the channel scaling type (auto, fixed, etc.).

(b) **Scale Types Off**. Turns off a channel label showing the scaling type.

(8) The **Color** submenu provides the following selections:

(a) **Color Coding On**. Turns on color coding of arrivals.

(b) **Color Coding Off**. Turns off color coding of arrivals.

(9) **Auto Backup**. Causes an instant (out of cycle) save of ARS session.

e. The **Custom** menu provides the following selections:

(1) The **Set Scaling** submenu provides the following selections:

(a) **Auto**. Sets auto trace scaling.

(b) **AutoCenter**. Autocenters the trace if needed (e.g., DC shift).

(c) **Resize**. Resizes channels with each scroll in time.

(d) **Fixed**. Pops up the Fixed-scaling dialog.

(e) **Fixed-or-Max**. Sets channel scaling to fixed but scales to the maximum value if the maximum value exceeds the specified fixed window height.

(2) **Set Waveform Height**. Pops up the select dialog for waveform channel window height.

(3) **Arrival Spectrum**. Brings up a SpectraPlot window showing the amplitude spectra for both the arrival and for a period ten seconds before the onset time, so that they may be compared.

(4) The **Send** to submenu provides the following selections:

(a) **Maps**. Sends selected items to the Map.

(b) **SpectraPlot**. Sends selected channel/data intervals to SpectraPlot.

(c) **Discrim**. Sends selected origins to Discrim.

(d) **XfkDisplay**. Sends selected arrivals to XfkDisplay.

(5) The **Select List** menu provides the following selections:

(a) **Clear Select List**. Clears select list.

(b) **Add All Origins**. Adds all origins to the selection list (not merely those selected).

(c) **Add All Channels**. Adds all channels to the selection list (not merely those selected).

(d) **Add Assoc Arrivals**. Adds all arrivals associated with currently selected origins to the selection list.

(e) **Add All Arrivals in Window**. Adds all arrivals in current window to the selection list.

(f) **Add Unassoc Arrivals in Window**. Adds all unassociated arrivals in current window to the selection list.

(g) **Store Select List**. Stores selection list for future recall.

(h) **Recall Select List**. Recalls the previously stored selection list.

(6) The **Undo Functions** submenu provides the following selections:

(a) **Undo Retime**. Restores arrivals onset time to previous value.

(b) **Undo Rename**. Restores previous names to all selected renamed arrivals.

(c) **Undo Nullify**. Restores parameters to a nullified arrival.

(7) **Repair Timebar**. Removes all zoom and alignments.

(8) The **Mixed Events** submenu provides the following selections:

(a) **Remove Selected Origins**. Remove Selected Origins from the Selection List.

(b) **Clear Mixed Event List**. Remove mixed event origins from the Selection List.

(c) **Set Selected Channel Samples.** Pops up a Select dialog for the number of seconds of data to hold in memory (used only for hydroacoustic data).

(d) **Set Displayed Channel Samples**. Pops up a Select dialog for the number of seconds of data to display (used only for hydroacoustic data).

(9) The **Center Elements** submenu provides the following selections:

(a) **Show for Selected Channel**. Shows the center element raw data channel.

(b) **Unshow for Selected Channel**. Removes the center element raw data channel.

f. The **Help** menu provides the following selections:

(1) **About Help**. Instructions for using Help.

(2) **List Accelerator Keys**. Shows control-key sequences.

(3) **Show Channel Reference**. Shows channel naming conventions.

(4) **Menu Help**. Brings up a ? pointer to get help on a selected menu item.

(5) **Widget Help**. (Not implemented for analyst environment).

(6) **About ARS**. Copyright notice.

3-288. LOCATOR DIALOGUE.

3-289. The Locator Dialogue displays event location information and allows the analyst to specify and manipulate various locator controls and parameters (figure 3-37).

3-290. The uppermost section of the Locator Dialogue displays the alphanumeric information for the surface, unrestrained and restrained origin solutions (denoted by S, F and R, respectively, in the Locator Dialogue Run column), with one highlighted as the

preferred solution (lowest Sdobs), for the most recent run of the location algorithm. The scrollable window, located below the three origin solutions, displays the alphanumeric information for the previous preferred origin solutions for the event. The lower part of the Locator Dialogue displays the controls that allow the analyst to constrain the origin time, latitude, longitude and depth as well as providing buttons to **Hide** the Locator Dialogue, **Locate** the event, display information about the **Arrivals** (e.g., time/magnitude, defining/ non-defining), access the (**Locator**) **Controls** popup, and display **Help** information.

a. The alphanumeric information listed with each origin solution includes:

(1) **Date/Time**. The origin time.

(2) **Lat**. The origin latitude.

(3) **Lon**. The origin longitude.

(4) **Depth**. The origin depth in kilometers with respect to sea level. The unrestrained solution is the only solution that will incorporate depth phases. The depth for the restrained solution will default to the free solution's depth if the depth is not explicitly fixed/specified by the analyst.

(5) **Run**. Identifies the solution as the surface (S), free/unrestrained (F) or restrained (R) solution.

(6) **Sdobs**. The RMS travel time residual.

(7) **Ndef**. The number of observations used to define/constrain the solution.

- - NOTE - -

The number will not necessarily be equal to the number of detecting stations. Poor quality detections may be associated with the origin but not used as defining phases. Other stations may provide/contribute information for the initial P, depth, and horizontal phases.

(8) **Area**. The four-letter event location identification/characterization/ classification string.

(9) **Confidence Smajax**, **Sminax**, **Az**, and **Area** fields provide geometric information about the lengths of the semi-major and semi-minor axes, the orientation/strike of the semi-major axis, and the area of the 95 percent Confidence ellipse.

(10) **Coverage Smajax**, **Sminax**, **Az**, and **Area** fields provide geometric information about the lengths of the semi-major and semi-minor axes, the orientation/strike of the semi-major axis, and the area of the coverage ellipse.

(11) **Iter**. The number of iterations used to calculate the solution.

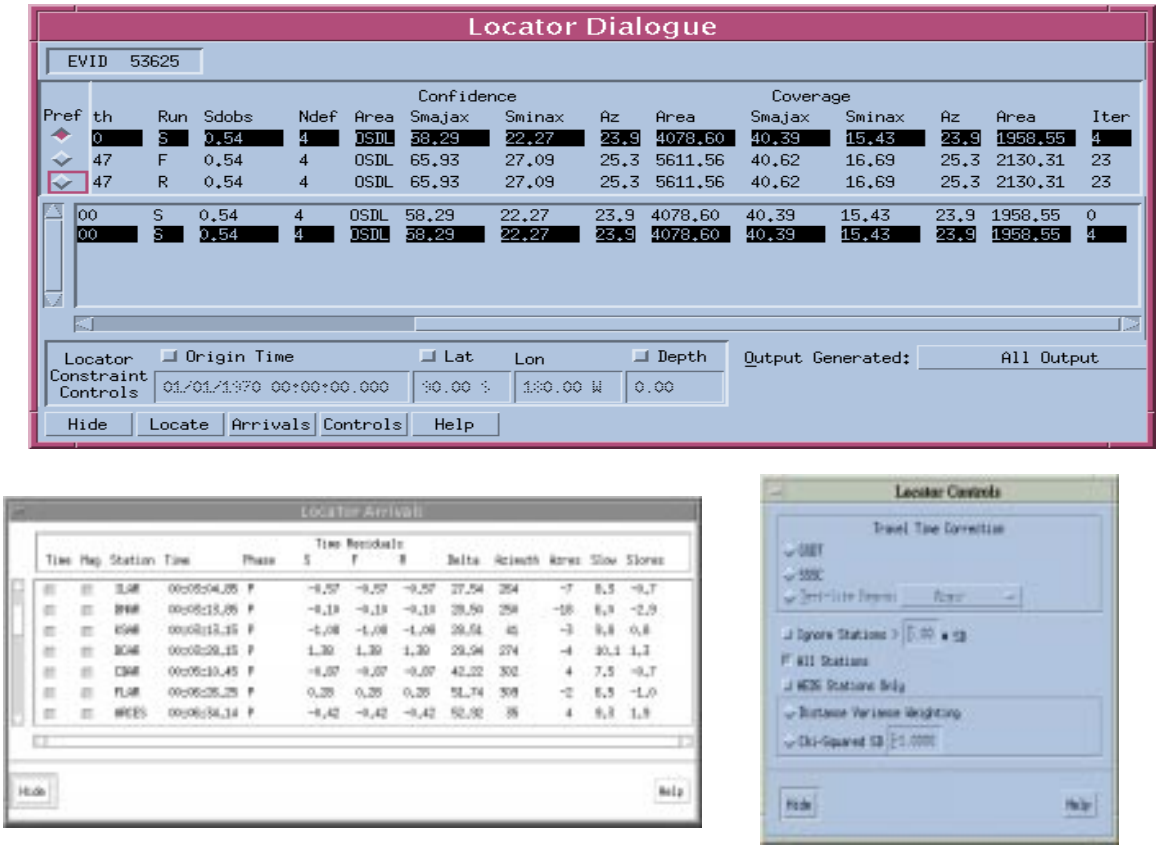

Figure 3-37. The Locator Dialogue, Arrivals, and Controls Popup Windows

b. **Locator Constraint Controls**. The section of the Locator Dialogue which allows the analyst to specify constraints that will be applied only to the constrained (R) origin solution. Any combination of time, lat/lon, depth parameters can be specified; these constraints will be applied to the next computation cycle.

(1) **Origin Time**. Fix the origin time of the restrained (R) solution to the specified value.

(2) **Lat, Lon**. Fix the latitude and longitude of the restrained (R) solution to the specified values.

(3) **Depth**. Fix the depth of the restrained (R) solution to the specified value.

c. **Output Generated**. The menu allows the analyst to specify/select the level of detail/amount of information the location algorithm outputs to the ARS scheme window).

d. **Hide**. Remove the Locator Dialogue from the display.

e. **Locate**. Invoke the location algorithm.

f. **Arrivals**. Display the following information in the **Locator Arrivals** popup:

(1) **Time**. Used to toggle an arrival between time defining/non-defining. The arrival can also be toggled between defining/non-defining in the **AlphaList**.

(2) **Mag**. Used to toggle an arrival between magnitude defining/non-defining. The arrival can also be toggled between defining/non-defining in the **AlphaList**.

(3) **Station**. Station ID.

(4) **Time**. The detection's arrival time.

(5) **Phase.** The detection's phase ID.

(6) **Time Residuals**. Arrival time residuals for the surface (S), unconstrained (F) and constrained (R) solutions.

(7) **Delta**. Distance (in degrees) between the station and the preferred origin.

(8) **Azimuth**. Arrival's propagation direction estimated using f-k analysis.

(9) **Azres**. Difference between the arrival's observed and theoretical propagation (based on the preferred origin's location).

(10) **Slow**. Arrival's slowness estimated using f-k analysis.

(11) **Slores**. Difference between the arrival's observed and theoretical slowness (based on the preferred origin's location).

g. **Controls**. The **Locator Controls** window allows the analyst to toggle between, select, and specify various control parameters.

(1) **Travel Time Corrections**. Only one of the following can be selected:

(a) **SSSC**. Toggle the **SSSC** travel-time corrections on/off.

(b) **Test-Site Region**. Toggle the test-site travel time correction on/off. If on, select the appropriate site from the menu.

(c) **Generalized Source-Dependent Time Corrections (GSDT)**. Toggle the GSDT corrections on/off.

(2) **All Stations**. Use all stations (on), or only those stations with test-site or SSSC travel-time corrections (off).

(3) **AEDS Stations Only**. Use only those stations included in the United States Atomic Energy Detection System (USAEDS) network.

(4) **Variance Weighting Options**. Only one of the following options can be selected.

(a) **GSDT/Distance Variance Weighting**. Incorporate distance dependent modeling errors in the time residual weights.

(b) **SSSC/Distance Variance Weighting**. Incorporate SSSC modeling errors in the time residual weights.

(c) **Chi-Squared SD**. Weight the time residuals by a user specified value.

h. **Help**. Display a popup with short descriptions of the Locator Dialogue toolbar buttons.

3-291. MAGNITUDE DIALOG.

3-292. The Magnitude Dialog displays event magnitude information as well as allowing the analyst to specify and manipulate various magnitude controls and parameters (figure 3-38).

3-293. The upper most section of the Magnitude Dialog displays the alphanumeric for the surface, unrestrained and restrained origin solutions (with one marked as the preferred solution) for the most recent run of the location algorithm. The scroll-bar window located below the magnitude information for the three origin solutions displays the alphanumeric information for the event's previous preferred origin solutions. The lower part of the Magnitude Dialog displays the number of observations used to estimate the corresponding estimate (e.g., the mb, MLmb, ms, MLms, Cor mb and Cor ms), and control buttons.

a. The Magnitude Dialog displays the magnitude information corresponding to the surface (S), free/unrestrained (F) and restrained (R) origin solutions. The parameters corresponding to the preferred origin solution are highlighted. The columns of this display represent:

(1) **Run**. Indicates that the alphanumeric corresponds to the surface(S), free/unrestrained (F), or restrained (R) solution.

(2) **mb**. Body wave magnitude estimate.

(3) **SD**. Standard deviation of the body wave magnitude estimate.

(4) **MLmb**. Maximum likelihood body wave magnitude estimate. Computed using observations from both detecting and non-detecting stations.

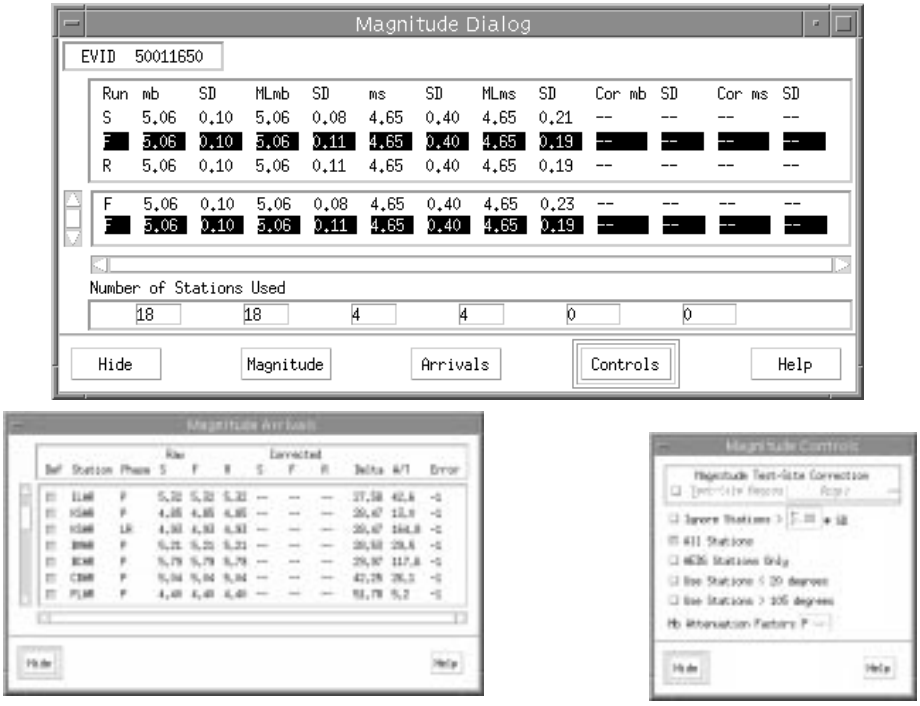

Figure 3-38. The Magnitude Dialog, Arrivals, and Controls Popups

(5) **SD**. Standard deviation of the maximum likely body wave magnitude estimate.

(6) **ms**. Surface wave magnitude estimate.

(7) **SD**. Standard deviation of the surface wave magnitude estimate.

(8) **MLms**. Maximum likelihood surface wave magnitude estimate. Computed using observations from both detecting and non-detecting stations.

(9) **SD**. Standard deviation of the maximum likelihood surface wave magnitude estimate.

(10) **Cor mb**. Body wave magnitude estimate computed using the correction factors specified in the Magnitude Controls popup.

(11) **SD**. Standard deviation of the corrected body wave magnitude estimate.

(12) **Cor ms**. Surface wave magnitude estimate computed using the correction factors specified in the Magnitude Controls popup.

(13) **SD**. Standard deviation of the corrected surface wave magnitude estimate.

b. The scrollable section in the middle of the **Magnitude** dialog lists the alphanumeric information for the event's previous preferred solutions; the parameters associated with the most recent preferred solution are at the bottom.

c. **Number of Stations Used**. The number of defining observations used to estimate the associated magnitude (mb, MLmb, ms, MLms, Cor mb, and Cor ms, respectively).

d. The buttons at the bottom of the **Magnitude** dialog provide access to the following functions/options:

e. **Hide**. Removes the **Magnitude Dialog** from the display.

f. **Magnitude**. Recomputes the magnitude without performing a relocation.

g. **Arrivals**. Display the following information in the **Magnitude Arrivals** popup:

(1) **Def**. Button used to toggle an arrival between magnitude defining/non-defining. The arrival can also be toggled between defining/non-defining in the **AlphaList**.

(2) **Station**. Station ID.

(3) **Phase**. The detection's phase ID.

(4) **Raw**. The single station mb and ms estimates (depending on the phase type) for the surface (S), unconstrained (F) and constrained (R) origin solutions.

(5) **Corrected**. The (S), free/unconstrained (F) and constrained (R) origin solutions computed using the correction factors specified in the Magnitude Controls popup.

(6) **Delta**. Distance (in degrees) between the station and the preferred origin.

(7) **A/T**. The arrivals amplitude/period parameter.

h. **Controls**. Display a window with the following configuration options.

(1) **Magnitude Test-Site Correction**. Apply magnitude corrections for the test-site selected from the Test-Site Region selection list.

(2) **All Stations**. Uses only those stations with Test-Site corrections.

(3) **AEDS Stations Only**. Use only those stations included in the USAEDS network.

(4) **Use Stations < 20**. Use P observations (Pn and Pg observations will not be used) at stations less than 20 degrees from the source.

(5) **Use Stations > 105**. Use P observations at stations greater than 105 degrees from the source.

(6) **Mb Attenuation Factors**. Apply Veith-Clawson (P, default) or Gutenberg-Richter (B) distance-depth attenuation corrections.

i. **Help**. Display information about the **Magnitude** dialog buttons.

3-294. XFKDISPLAY.

3-295. XfkDisplay is an interactive tool that allows the analyst to compute and display f-k parameters for seismic array data (e.g., azimuth and slowness), particle motion/polarization parameters for three-component data, and the associated beams for both array and three-component data. XfkDisplay (figure 3-39) provides menus and options that allow the analyst to tailor the input parameters (e.g., contributing channels, frequency band, data window size and location) to suit his/her needs.

a. The **File** menu has one selection: **Exit.**

b. The **Edit** menu provides the following selections:

(1) **Stations**. Pops up the Stations select dialog.

(2) **Parameters**. Pops up the Recipe List select dialog.

(3) **Calculate**. Recalculates the f-k parameters for all selected arrivals.

(4) **Sites**. Pops up the Station List select dialog to edit channels included.

(5) **Send Arrival(s) to ARS**. Sends updated f-k parameters to ARS.

(6) **Copy Arrival**. (Inactive.)

(7) **Delete Arrival**. Clears selected arrivals from the XfkDisplay list.

c. The **View** menu provides the following selections:

(1) **Display f-k**. Pops up a new f-k spectrum window for each selected arrival, even if one already exists.

(2) **Update Display**. Restores display.

3-296. SPECTRAPLOT.

3-297. The SpectraPlot GUI is an interactive tool that allows the analyst to compute and display power spectral density, amplitude, and phase estimates for various types of time-series data (figure 3-40). The SpectraPlot GUI provides menus and options that allow the analyst to tailor the input and display parameters (e.g., type of data taper, log versus linear scaling) to suit his/her needs.

a. The **File** menu provides the following selections:

(1) **Compute**. Recomputes the spectrum.

(2) **Save**. Pops up the file **Save As** dialog.

(3) **Print Graph**. Sends the graph to the printer.

(4) **Quit**. Terminates SpectraPlot.

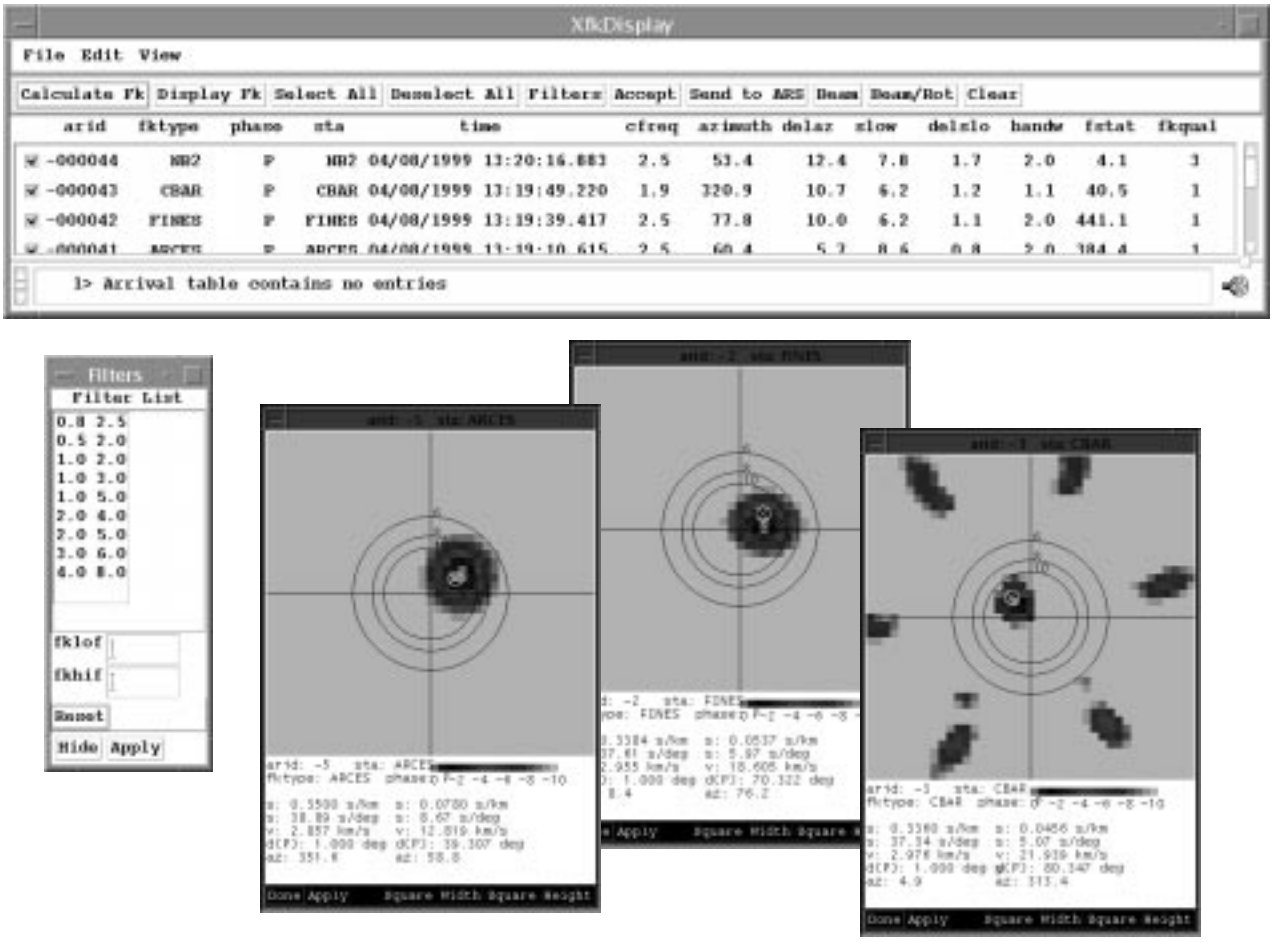

Figure 3-39. XfkDisplay Windows

b. The **Edit** menu provides the following selections:

(1) The **Spectrum** submenu provides the following selections:

(a) **Power**.

(b) **Amplitude**.

(c) **Phase**.

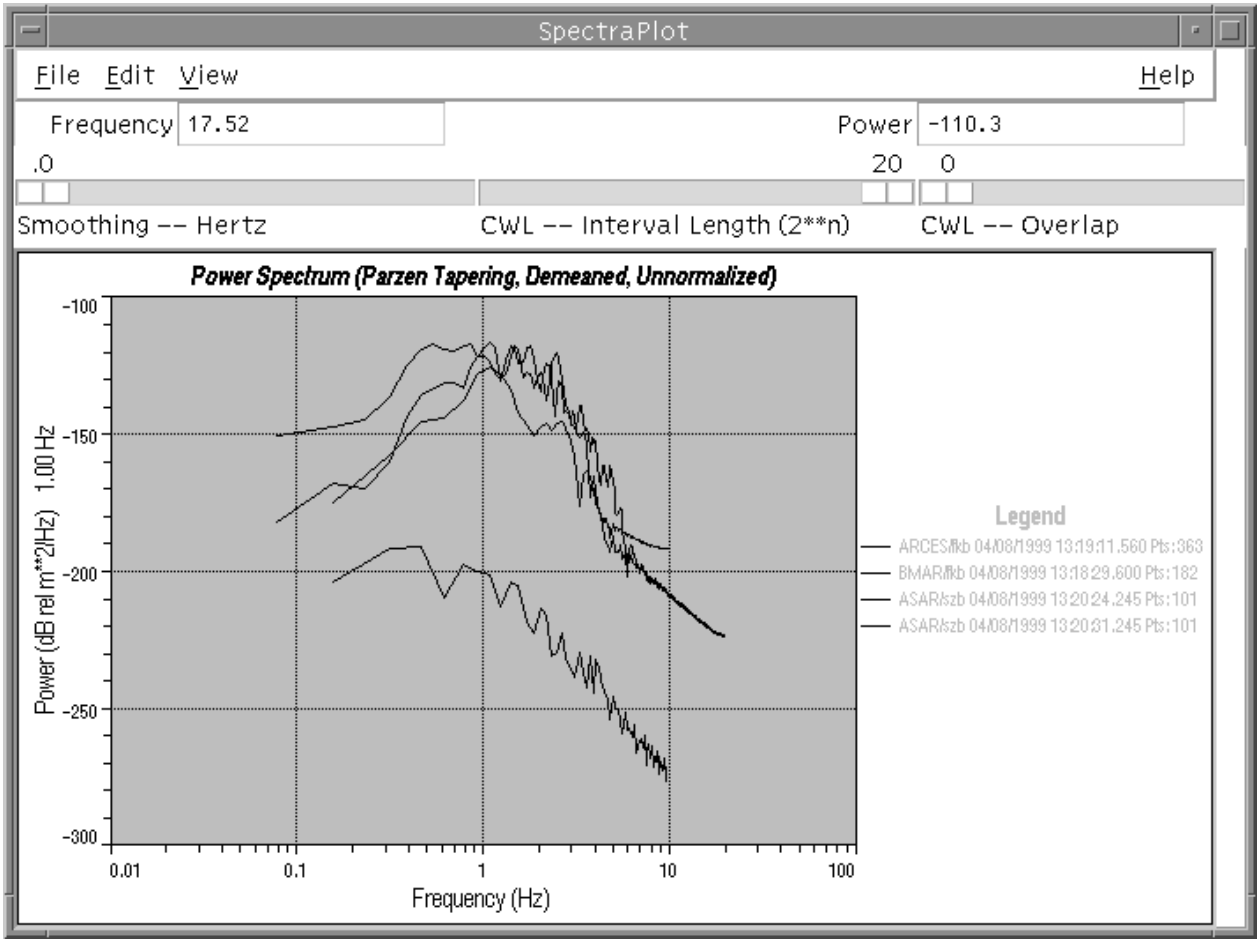

Figure 3-40. SpectraPlot GUI

(2) The **Taper** submenu provides the following selections:

(a) **Parzen**. Apply Parzen taper to both ends of the sample interval.

(b) **Hanning**. Apply Hanning taper to both ends of the sample interval.

(c) **Hamming**. Apply Hamming taper to both ends of the sample interval.

(d) **Blackman**. Apply Blackman taper to both ends of the sample interval.

(e) **Welch**. Apply Welch taper to both ends of the sample interval.

(f) **None**. Do not apply any taper.

(3) **Demean**. Remove the mean from the sample interval before computing the spectrum.

(4) **Normalize**. Display all curves normalized to the peak value.

(5) **dB Scale**. Toggles the vertical units/scaling from decibels to amplitude.

(6) **Inst. Correction**. Toggles the Instrument Correction on and off.

(7) The **Units** submenu provides the following selections:

(a) **Displacement**. Use Displacement units (nm).

(b) **Velocity**. Use Velocity units (m/s).

(c) **Acceleration**. Use Acceleration units (m/s**2).

(8) **Clear**. Clears the display.

(9) **Redraw**. Not active.

c. The **View** menu provides the following selections:

(1) **Display**. Pops up data display dialog.

(2) **Zoom (on/off)**. Turns rubber-band zooming on and off.

(3) **Zoom out**. Zooms out to the previous zoom level

(4) **Log x**. Displays the abscissa with logarithmic scale.

(5) **Grid**. Toggles grid lines on or off.

(6) **Coordinates**. Not active.

(7) **Smoothing**. Not active.

(8) **Line style**. Not active.

(9) **Vertical label**. Not active.

d. The **Help** menu is not active.

3-298. MAP.

3-299. The Map GUI is an interactive tool that allows the analyst to display cartographic information and graphical information about the azimuth and calculated delta of arrivals. The Map GUI provides menus and options that allow the analyst to display and overlay various types of spatial information such as station locations, latitude and longitude grids, historical seismicity, and event locations and error ellipses (figure 3-41).

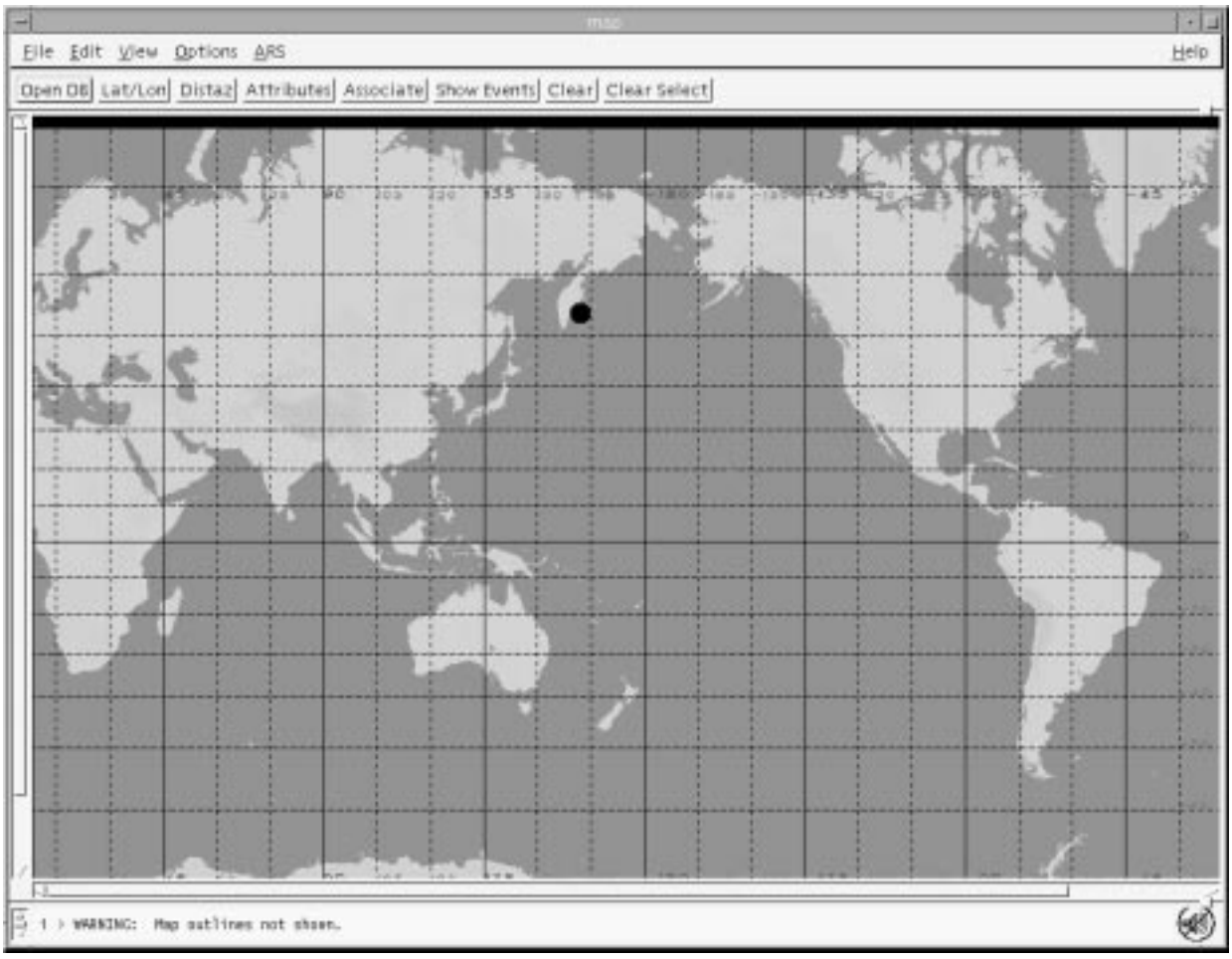

Figure 3-41. Map GUI

a. The **File** menu provides the following selections:

(1) **New Database**. Pops up a dialog to select a database.

(2) **Exit**. Terminates the Map program.

b. The **Edit** menu provides the following selections:

(1) **Object Database Query⇒Arrivals** submenu provides the following selections:

(a) **Enter/Edit query**. Pops up the Enter/Edit query dialog.

(b) **Select query**. Pops up the Select Arrival Table query dialog.

(2) The **Object Database Query⇒Origins** submenu provides the following selections:

(a) **Enter/Edit query**. Pops up the Enter/Edit query dialog.

(b) **Select query**. Pops up the Select Origin Table query dialog.

(3) The **Object Database Query⇒OriginOrigerrs** submenu provides the following selections:

(a) **Enter/Edit query**. Pops up the Enter/Edit query dialog.

(b) **Select query**. Pops up the Select Origerr Table query dialog.

(4) The **Object Database Query⇒Sites** submenu provides the following selections:

(a) **Enter/Edit query**. Pops up the Enter/Edit query dialog.

(b) **Select query**. Pops up the Select Origerr Table query dialog.

(5) **Remove all objects**. Removes all optional objects from the display.

(6) The **Edit Selected Objects** menu provides the following selections:

(a) **Store Selected objects**. Stores the selected objects for later recall.

(b) **Recall Stored Objects**. Recalls the previously stored selected objects.

(c) **Deselect Objects**. Releases objects from selection.

(d) **Remove selected objects**. Removes selected objects from the map.

(7) The **Edit Layers** submenu provides the following selections:

(a) **Define Layer**. Pops up the Layer Define dialog.

(b) **Select Layer**. Pops up the Layer Select dialog.

c. The **View** menu provides the following selections:

(1) The **View Objects** submenu provides the following selections:

(a) **Draw All Objects**.

(b) **Undraw All Objects**.

(2) The **View Selected Objects** submenu provides the following selections:

(a) **Undraw Selected Objects**.

(b) **Object Attributes**.

(3) The **Map Outlines** submenu provides the following selections:

(a) **Show**. Plots all the map outlines within the current map.

(b) **Unshow**. Removes the map outlines.

(c) **Show Selected Map**. Changes the map to the one whose outline was selected.

(4) The **View Maps** submenu provides the following selections:

(a) **Change Map**. Pops up the Map select dialog.

(b) **Pop Map Stack**. Brings up the previous map in the stack.

(c) **Roll Map Stack**. Brings up the next map in the stack.

(d) **Type Map Stack**.

(e) **Swap Map Stack**.

(5) The **Change Ellipse Type** submenu provides the following selections:

(a) **Coverage**. Shows Coverage Ellipses.

(b) **Confidence**. Shows Confidence Ellipses.

(c) **Both**. Shows Coverage and Confidence Ellipses together.

(6) **Change Colors**. Pops up the Color Selection List dialog.

(7) The **Overlay** submenu provides the following selections:

(a) **Test Sites**. Toggles test sites on and off.

(b) **Overlay List**. Pops up the Overlay select dialog.

d. The **Options** menu provides the following selections:

(1) **Latitude and Longitude**. Displays the latitude and longitude of the last picked (middle mouse button) point.

(2) **Distance and Azimuth**. Displays the distance and azimuth between the last two picked (middle mouse button) points.

(3) **Clear Points**. Clears all the picked points from the map.

(4) **Type Point Coordinates**. (Not active.)

e. The **ARS** menu provides the following selections:

(1) **Add Select List**. Adds selections to the Selection List.

(2) **Clear, Add Select List**. Clears the Selection List and then adds selections to the Selection List.

(3) **ZAS**. Causes ARS to zoom, align and sort (ZAS) on the single selected origin

(4) **COLA and Map**. Uses selected arrivals to create a new origin, locate it, align ARS on initial arrivals, and send the origin to the Map.

(5) **Template Prediction**. Creates an origin at the picked geographic point, sends the origin to ARS, causes ARS to align on the new origin and predict initial arrivals, sends all unassociated arrivals in the window to the Map.

3-300. DISCRIM.

3-301. Event Discriminator (Discrim) is an interactive tool that allows the user to display, review, and correct individual classification measurements as well as overall classification results for seismic observations. (See figure 3-42.) Discrim uses the classification scheme described in the AFTAC/TTR Event Classification Procedures for the Seismic Technique document.

Figure 3-42. Discrim Windows

a. The **File** menu provides the following selections:

(1) **Add Origin**. Pops up a dialog for entering database and origin.

(2) **Exit**. Terminates Discrim.

b. The **File** menu in each detail display has one choice: **Exit**.

3-302. HYDRODISPLAY.

3-303. Hydrodisplay is an interactive tool that allows the analyst to display, review and correct the individual classification measurements and the overall classification results for hydroacoustic observations (figure 3-43).

3-304. PROCESSORID.

3-305. ProcessOrid provides an interface that allows the analyst to recompute origin beams and various measurements for a specified orid (figure 3-44).

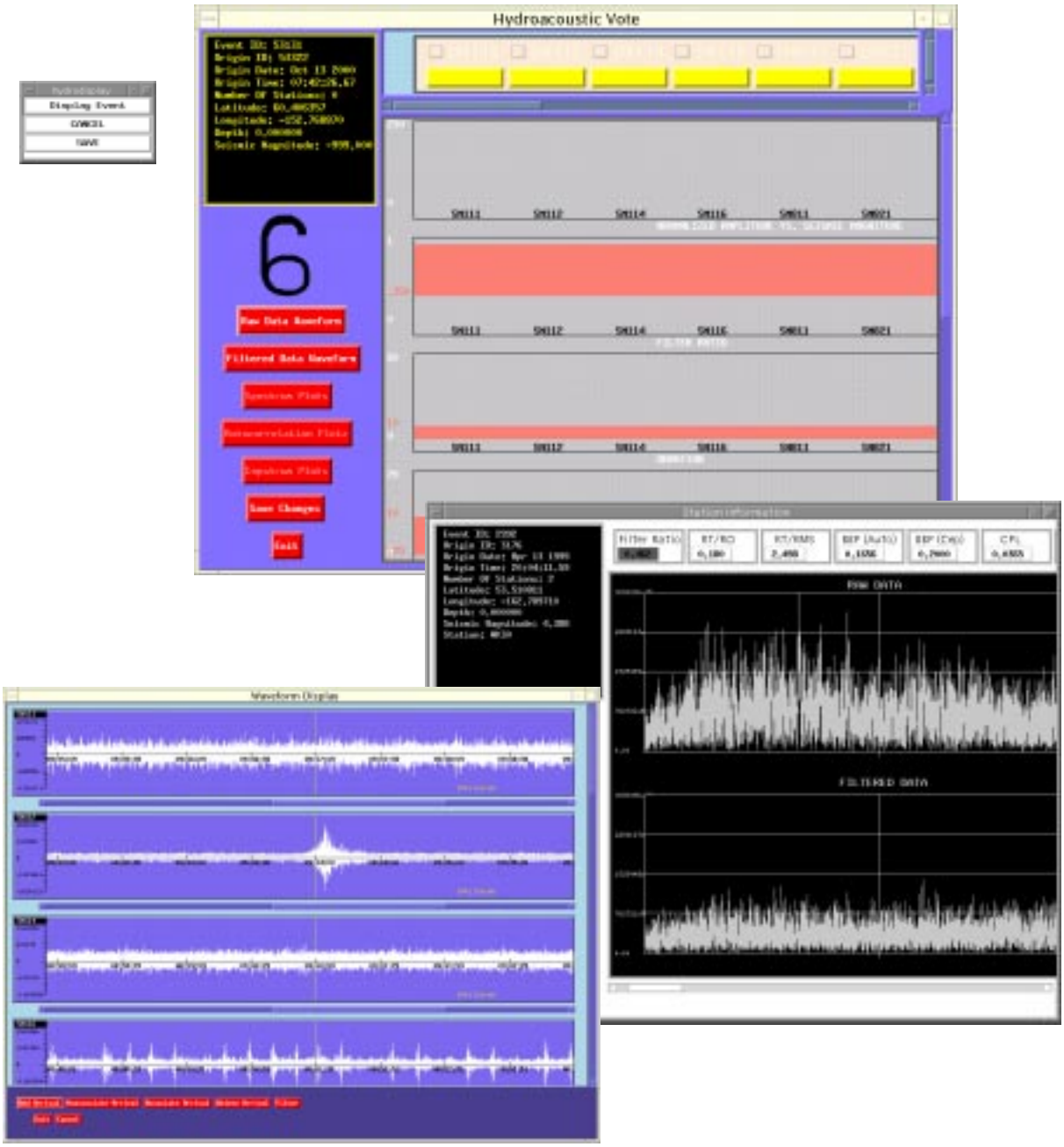

Figure 3-43. Hydrodisplay Windows

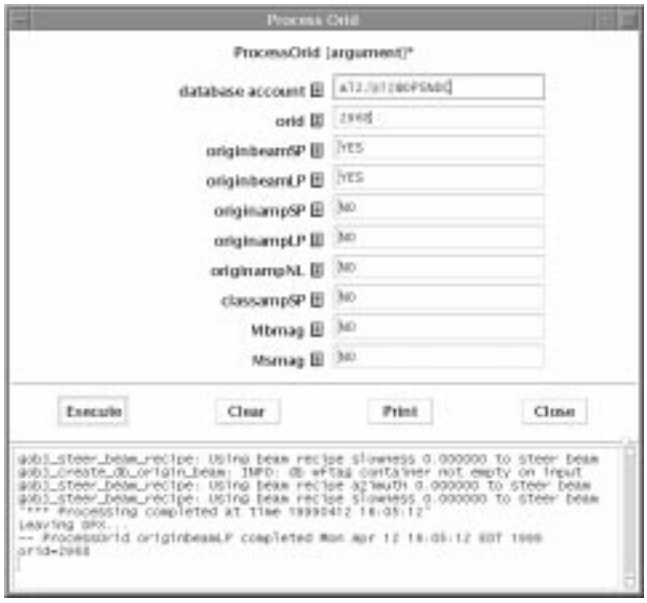

Figure 3-44. ProcessOrid Window

3-306. ANALYST TERMINAL LOGIN AND INITIAL SETUP.

3-307. Figure 3-45 shows an example of an analyst desktop. Because the user can customize the environment, the actual desktop may differ somewhat in appearance. Perform login and initial setup as follows:

a. Enter user name and then password in the login window. If dman does not appear shortly after login, notify the SOM.

b. Select **Programs⇒Launch** menu item from dman (figure 3-46).

c. Select **ARS**, **Map**, and **XfkDisplay** from the resulting **Launch Programs** popup.

d. Select **Launch** from the **Launch Programs** popup.

e. If desired, select **Dismiss** from the **Launch Programs** popup to remove it from the display.

f. Iconify the dman window by selecting the **Minimize** button in the upper right corner of the dman window.

Figure 3-45. Initial Analyst Desktop

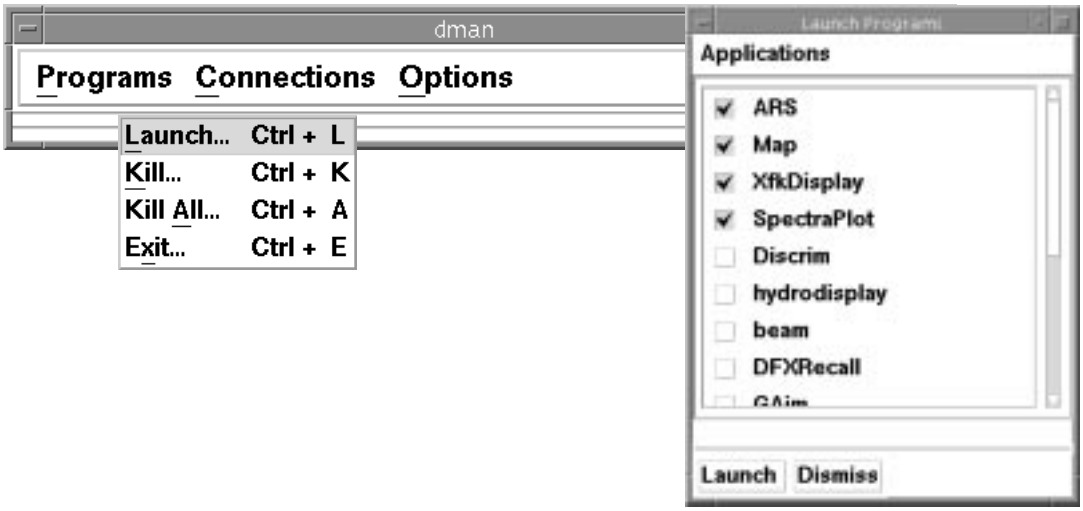

Figure 3-46. Launching ARS, Map, and XfkDisplay from dman

3-308. READING DATA.

3-309. In order to perform analysis of data from any of the available accounts, the analyst must first read the desired interval from the selected account into ARS (figure 3-47). The following procedures identify the method for reading data:

a. Check with the SOM to verify that the desired data interval is available.

b. Select **File⇒Open⇒(menu option for the account to load)**.

c. If the time block, network, and database listed in the resulting popup are correct, select **Done**.

d. If the time block, network, and database listed in the resulting popup are not correct:

(1) Enter desired time block, network and/or database.

(2) Select **Done**.

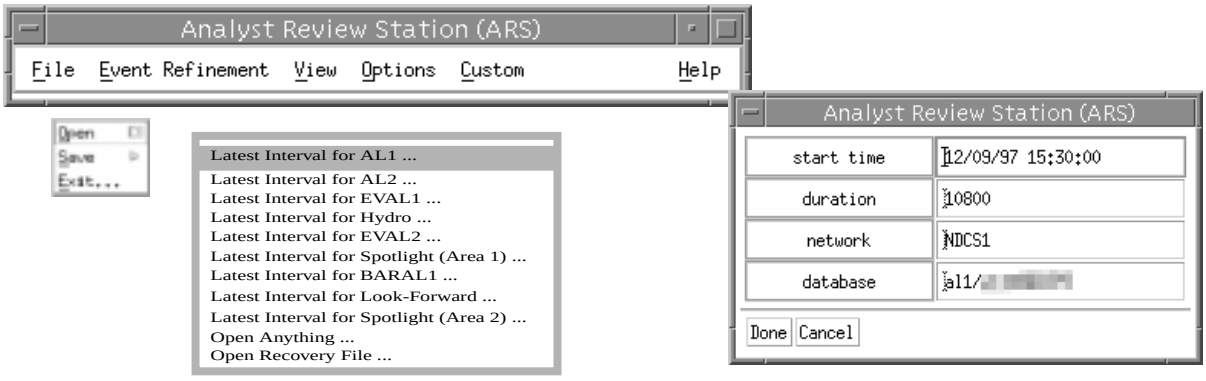

Figure 3-47. Reading Data into ARS

3-310. If ARS session crashes while data is being worked, perform the following steps to read data from the ARS recovery file and restore the work:

a. Select the **File⇒Open⇒Open Recovery File** menu item in ARS.

b. The resulting popup should list the parameters appropriate for the time block that was being analyzed when the crash occurred.

3-311. AL1 ANALYSIS PROCEDURES.

3-312. Perform read data procedure as specified in paragraph 3-308.

3-313. DATA ANALYSIS SEQUENCE.

3-314. The following is a general outline of the analysis sequence for SEA1. Detailed procedures for each of the steps (which are, in most cases, common to SEA1, SEA2, EEA, Spotlight and Look-Forward analysis) are covered in separate sections.

a. Notify the SOM if an event is a Code 1, Code 2 or Code 3 (Codes are defined in the Center OI).

b. Work the highest priority, largest event first.

c. Select the desired event from the top of the ARS display.

d. Select **ZAS (Zoom Align and Sort by Distance)** from the ARS toolbar.

e. Select **AlP** from the ARS toolbar to invoke the **AlphaList**.

- - NOTE - -

An ARS popup window is activated when an arrival is retimed more than two seconds and less than five seconds. Warning message indicates that measurements/magnitudes are no longer valid and that arrivals MUST be remeasured.

f. Work the initial P arrivals (retime, etc.; refer to paragraph 3-393).

g. If possible, locate the event using arrival time information only. For example, select **TimeDef** button on the **AlphaList**. This will toggle **timedef** fields in the **AlphaList** to **d**, and the **azdef** and **slodef** fields to **n**).

h. Select **Algn P** from the ARS toolbar.

i. Scroll through the channels to check for missed detections (select **Show P** from the ARS toolbar to display the theoretical initial P arrival times for each site).

j. Predict for depth phases (refer to paragraph 3-413).

k. Predict for S phases (refer to paragraph 3-413).

l. Predict for later, non-defining short-period phases (refer to paragraph 3-418).

m. Locate the event (refer to paragraph 3-389).

n. Select **OrAl** from toolbar.

o. Ensure that all defining buttons are correct (e.g., **timedef**, **azdef**, **slodef**).

p. Finalize event location/solution.

q. Select **File⇒Save⇒Save Single Origin** to save the origin and all associated arrivals to the output database.

r. Enter the appropriate comments (e.g., name, analyst position) in the **Edit Origin's Remarks** popup.

s. Select **Done**.

t. Repeat steps a. through s. for all events in the two-hour time block.

u. Select **File⇒Save⇒Save Data** to initiate the auto-pipeline processing for the saved interval.

v. Popup activated in ARS when **Save Data** is selected and there are origins coded Axxx that have not been saved or deleted (see figure 3-48).

w. Log off when finished (refer to paragraph 3-433).

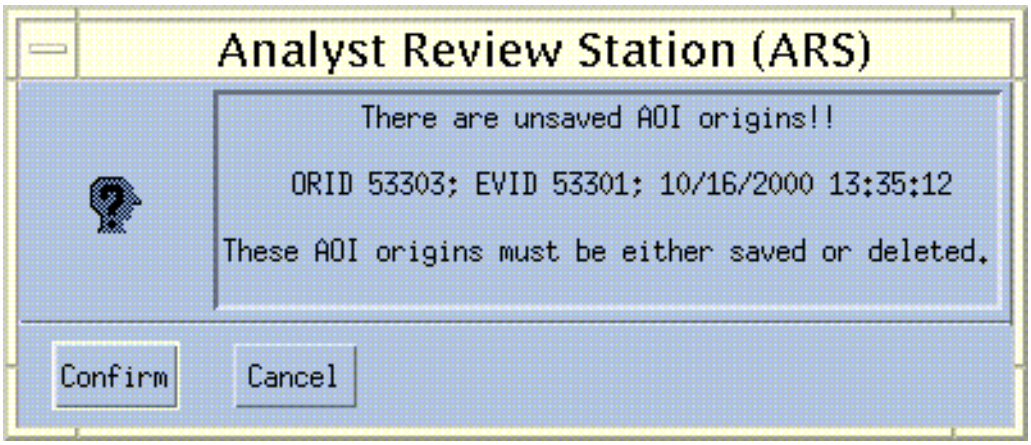

Figure 3-48. AOI Events

3-315. AL2 ANALYSIS PROCEDURES.

3-316. Perform read data procedure as specified in paragraph 3-308.

- - NOTE - -

The next ARS auto-AL1 interval should have completed processing before starting SEA2. Otherwise, the SEA1 analyst may save an event which will not be available to the SEA2 analyst.

3-317. DATA ANALYSIS SEQUENCE.

3-318. Perform data analysis sequence as follows:

a. Notify the SOM if an event is a Code 1, Code 2 or Code 3 (Codes are defined in the Center OI).

b. Work the highest priority, largest events first.

c. Select desired event, perform **ZAS**.

d. Read comments for any important information.

e. Press **Done** when finished.

- - NOTE - -

An ARS popup window is activated when an arrival is retimed more than two seconds and less than five seconds. Warning message indicates that measurements/magnitudes are no longer valid and that arrivals MUST be remeasured.

f. Select **AIP** from the ARS toolbar to display the event information including the initial arrivals.

g. Work initial arrivals (refer to paragraph 3-393).

h. Select **TimeDef** from **AlphaList** to use only arrival times in event location.

i. Locate event until standard deviation (SDV) acceptable (normally less than 1.0) (refer to paragraph 3-389, paragraph 3-288, and paragraph 3-397).

j. Select **AIP** to check for additional missed detections.

k. If necessary, predict for depth phases (refer to paragraph 3-414).

l. If necessary, predict for S phases (refer to paragraph 3-416).

m. Predict for later (non-defining) SP phases (refer to paragraph 3-418).

n. Predict for LP phases (refer to paragraph 3-420).

o. Locate event to sort any added arrivals.

p. Select **OrAl** from toolbar to display all associated arrivals.

q. Ensure all defining buttons are correct (**timedef**, **azdef**, **slodef**, and **magdef**).

r. Finalize event location/solution.

s. Select **File⇒Save⇒Save Single Origin**.

t. Enter appropriate comments (name, analyst position, and any appropriate information).

u. Repeat steps a. through t. for all events in two-hour time frame.

v. Work unassociated data (refer to paragraph 3-422).

w. Select **File⇒Save⇒Save Data** to initiate the auto-pipeline processing for the saved interval.

x. Log off when finished (refer to paragraph 3-433).

3-319. EVAL1 ANALYSIS PROCEDURES.

3-320. Perform read data procedure as specified in paragraph 3-308.

- - NOTE - -

The next ARS AL2 interval should have completed processing. If it has not, the SEA2 analyst may save an event prior to his time frame that will not be reviewed by the Event Evaluation Analyst (EEA).

3-321. DATA ANALYSIS SEQUENCE.

3-322. The following steps show the typical sequence of actions performed by the evaluation analyst once the data time frame has been loaded:

a. Select the first event to be evaluated by selecting the origin.

b. Perform **ZAS** to display the event.

c. Verify that all initial detections are associated to the event and timed correctly.

d. Check amplitude/period measurements and adjust as necessary.

e. Verify that all later phases are properly associated to event.

f. Check amplitude/period measurements and adjust as necessary.

g. Review long-period data and add/adjust LQ/LR detections as necessary.

h. Review long-period measurements and adjust as necessary.

i. Check for anomalous station magnitudes and, if necessary, adjust long-period and short-period amplitude and period measurements.

j. Review hydroacoustic data in the ARS session.

- - NOTE - -

If a hydroacoustic detection is added in ARS, DFXrecall must be run on the detection. Otherwise, Hydrodisplay will not recognize the detection and the HDT will crash.

k. Finalize event location/solution.

l. Save the event.

m. Run Discrim on the event if required. Review Discrim measurements and adjust/add as necessary (refer to paragraph 3-323).

n. Run HDT on the event.

o. Review hydroacoustic measurements and adjust/add as necessary.

p. Refilter channels as appropriate to identify signals related to event.

q. If additional detections are found, add them in the Hydrodisplay Raw Data Waveform window (refer to paragraph 3-330).

r. Repeat steps a. through q. for all events in two-hour time frame.

s. Select **File⇒Save⇒Save Data** to initiate the auto-pipeline processing for the saved interval.

t. Log off when finished (refer to paragraph 3-433).

3-323. DISCRIM ANALYSIS PROCEDURES.

3-324. LAUNCHING DISCRIM FROM ARS.

3-325. Use the following procedure to launch Discrim from ARS. This procedure initiates an automatic processing pipeline that makes many of the individual measurements needed for event classification. Figure 3-49 shows dman window during a processing sequence for the Discrim auto-pipeline.

a. Verify that the selected event is fully analyzed and that its parameters have been saved to the output database.

b. Verify that the selected event is fully analyzed and that its parameters have been saved to the output database.

c. Select the **Discrm** button from the ARS toolbar to initiate the automatic processing pipeline.

Figure 3-49. dman Window

3-326. LAUNCHING DISCRIM FROM DMAN.

3-327. The Discrim program can also be launched from dman.

- - NOTE - -

Launching Discrim in this manner does not initiate the automatic pipeline that creates current beams and makes many of the measurements needed for event classification. This procedure should, therefore, only be used for events that have passed through the Discrim auto-pipeline during a previous EEA analysis session and have not been altered subsequently.

a. Select **Programs⇒Launch** menu item/option from dman (figure 3-50).

(1) Select **Discrim** in the **Launch** popup.

(2) Select **Done**.

(3) When the main Discrim window appears, select the **File⇒Add Origin** menu item/option from the Discrim window (figure 3-51).

(4) Enter the appropriate **Database Account** and **Orid** in the **Add Origin** popup.

(5) Select **OK** in the lower left corner.

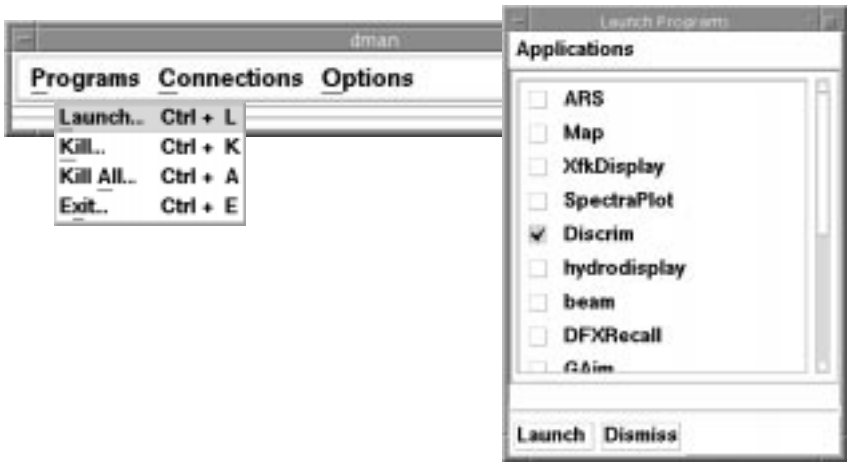

Figure 3-50. Launching Discrim from dman

Figure 3-51. Adding an Origin in Discrim

3-328. DATA ANALYSIS SEQUENCE.

3-329. Perform the following analysis sequence for each of the discriminants displayed in the main Discrim window (TT, PP, FM, LP, SP, CF).

- - NOTE - -

The AFTAC/TTR Event Classification Procedures for the Seismic Technique document (commonly referred to as Reference 11) specifies which measurements are used for each of the discriminants, and defines how each of the individual measurements that contribute to the discriminants is to be made. Discrim analysis cannot be successfully completed by an analyst who is not familiar with the Reference 11 document.

a. Select a discriminant to review (CF for this example) (figure 3-52).

b. To review the individual measurements for a station, select the waveform button/icon located below the station identification (ID).

c. To review/verify an individual measurement, select the measurement from the list at the top of the **Measurement Edit** window.

(1) The appropriately-filtered waveform, arrival, and measurement bounding-box will be displayed in the lower section of the **Measurement Edit** window.

- - NOTE - -

Individual measurements that contribute to the currently selected discriminant are designated in the Measurement Edit window using bold font. Any of the individual measurements can be selected and displayed, whether or not that particular measurement contributes to the currently selected discriminant.

(2) The associated measurement information will be displayed in the upper left portion of the **Measurement Edit** window.

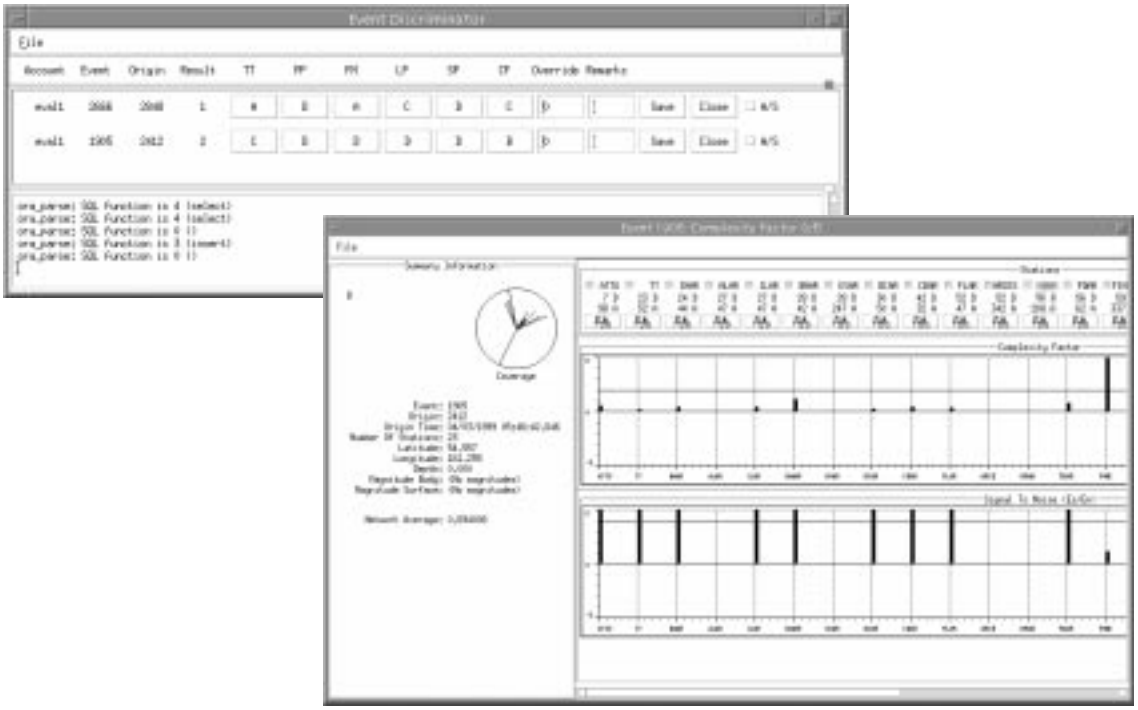

Figure 3-52. Discrim and the Complexity Factor (cf) Discriminant's Voting Screen

- - NOTE - -

Because the filters used to make measurements are different than those used to pick onset times, the detection timing may appear to be less than optimal.

d. To zoom the waveform display:

(1) Use the left mouse button (depress and move) in the waveform window to outline/define a zoom region (in both time and amplitude).

(2) The waveform display can be unzoomed by selecting the **Zoom Reset**.

e. To adjust the measurement:

(1) Place the cursor on the red triangles at the bottom of the waveform display.

(2) Use the left mouse button (depress and move) to adjust the start and/or end times of the measurement bounding box.

- - NOTE - -

Only the first half of the measurement bounding box is used in measurement (measurement is made for half period).

f. When the measurement has been adjusted, select **Apply** in the **Measurement Edit** window.

g. To add missing measurements (those marked **<not made>**):

(1) Select the measurement from the top of the **Measurement Edit** display.

(2) Select the appropriate channel from the data channel selections on left.

(3) Adjust the **Measurement Adjustment Controls** (red triangles) in accordance with the definitions in the Reference 11 document.

h. Repeat the above steps for the remaining individual discriminants:

(1) PP (Reflected Phases)

(2) FM (First Motion)

(3) LP (Magnitude Residuals)

(4) SP (Depth Residuals)

(5) TT (Travel Time)

i. Inspect each of the votes for the six discriminants to ensure proper classification of the events.

j. Use the **A/S** check-box in the **Overall Discriminant Summary** window to identify an event as an aftershock or not an aftershock.

k. Select **Save** in the **Overall Discriminant Summary** window save to the changes to the database.

l. Select **Close** in the **Overall Discriminant Summary** window to remove the event from the display.

m. Repeat the above steps for all Area of Interest (AI) and selected Outside Area of Interest (OAI) events.

n. Select the **File⇒Exit** to exit Discrim.

3-330. HYDRO DISCRIM PROCEDURES.

3-331. The goal of hydro discrim analysis is to verify the individual measurements made in the automatic pipeline and correct these measurements when necessary.

3-332. LAUNCHING HYDRODISPLAY FROM ARS.

3-333. Launch HDT from ARS as follows:

a. Select the frozen origin in ARS.

b. Launch HDT by selecting the **HDT** item from the ARS toolbar.

3-334. DATA ANALYSIS SEQUENCE.

3-335. Perform data analysis sequence as follows:

a. Select **Display Event** from the window. This will bring up the **Main Hydroacoustic Window** (figure 3-53).

b. Select **Raw Data Waveform Display** (figure 3-54).

c. To add a detection:

(1) Select **Add Arrival**.

(2) Using the middle mouse button, select the appropriate arrival time on the waveform.

d. To delete a detection:

(1) Select **Delete Arrival**.

(2) Using the middle mouse button, click on the arrival.

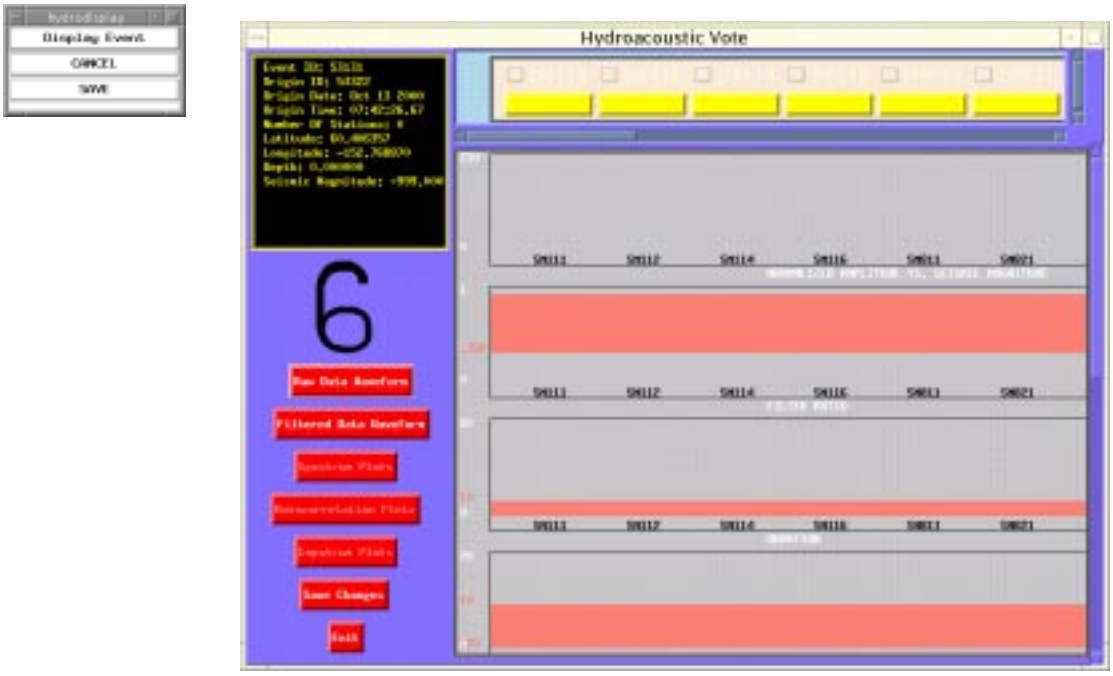

Figure 3-53. Main Hydroacoustic Window

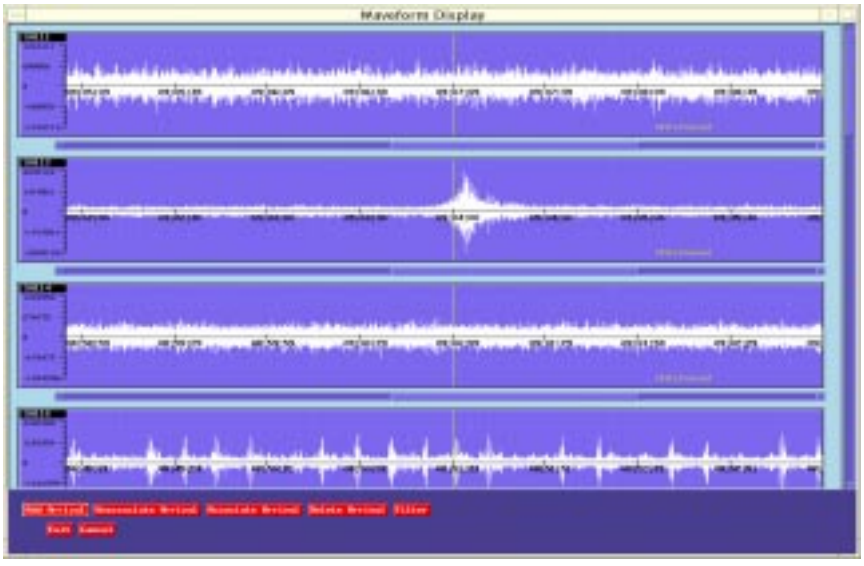

Figure 3-54. Hydroacoustic Raw Data Waveform Display Window

e. To associate a detection:

(1) Select **Associate Arrival**.

(2) Using the middle mouse button, click on the arrival.

f. To unassociate a detection:

(1) Select **Unassociate Arrival**.

(2) Using the middle mouse button, click on the arrival.

g. To select a filter, click on **Filter** in the waveform display window the HydroFiltering options popup will be displayed (figure 3-55):

(1) **Filter Setting** - Default is **Unfiltered**.

(a) Options: Default (from par files)

4-8 BP 3pole non-casual

5-20 BP 3pole non-casual

20-59 BP 3pole non-casual

30-30 BP 3pole non-casual

(b) Custom area allows building a new filter using the following options:

Filter Type: BP, HP, or LP

Low freq

Hi freq

Number of Poles

Filter Causality: causal or non-causal

(2) Stations - Allows filter settings to be applied to **All** Stations or to selected Stations available in the menu.

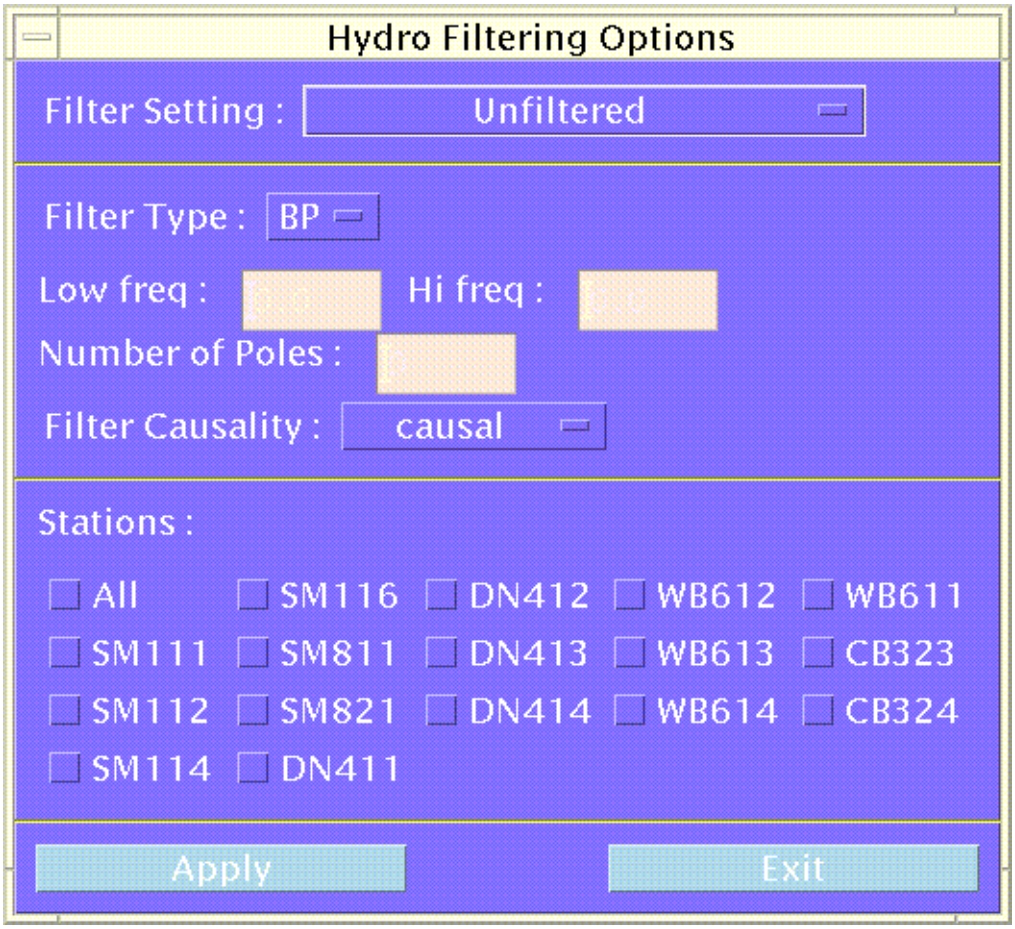

Figure 3-55. Hydro Filters

h. When all detection manipulations are finished, select **Exit** to return to the main window.

i. To view the detections at a set filter bandpass, select **Filtered Data**.

j. To view associated detections in either a linear or logarithmic display, select **Spectrum Plots**.

k. To view the autocorrelation measurements for associated stations, select **Autocorrelation Plots**.

l. To view the cepstrum measurements for associated stations, select **Cepstrum Plots**.

m. To view the **Filter Ratio** and view/adjust the **RT/RO**, **RT/RMS**, **BBP(Auto)**, **BBP(Cep)**, **CPL**, and **Duration** measurements (figure 3-56), select the waveform symbol box under the station designator from the Hydrodisplay Station Information Window.

n. Use the middle mouse button to adjust measurements.

o. Select **Exit** to return to main window.

p. Select **Exit** in the main window when event is finished.

q. In the Hydrodisplay window select either **Save** or **Cancel**. **Save** will write the changes to the database. **Cancel** will exit HDT without updating the database.

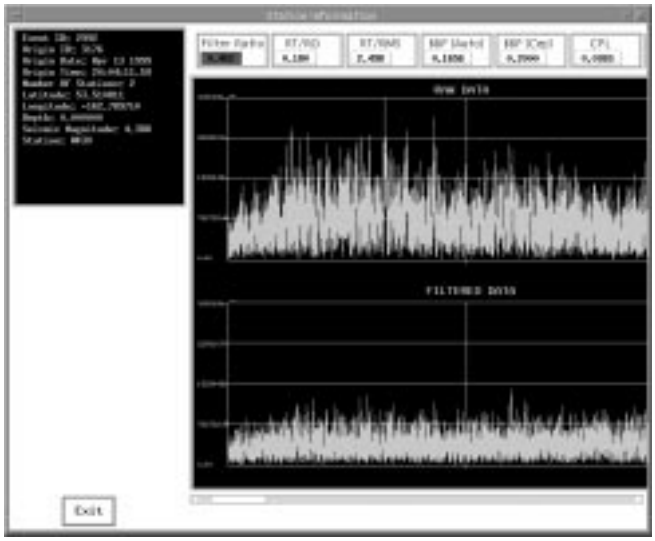

Figure 3-56. Hydrodisplay Station Information Window

3-336. SPOTLIGHT ANALYSIS PROCEDURES.

3-337. The purpose of Spotlight analysis is to rapidly identify and review all potential/actual events originating from the specific spotlight area(s) configured for this process.

3-338. Perform read data procedure as specified in paragraph 3-308.

3-339. SEISMIC DATA ANALYSIS SEQUENCE.

3-340. This section provides a general outline of the analysis sequence for processing seismic observations.

a. Notify the SOM if an event is a Code 1, Code 2, or Code 3 (Codes are defined in the Center OI).

b. Work the highest priority, largest events first.

c. Select the desired event from the top of the ARS display.

d. Select **ZAS** from the ARS toolbar.

e. Select **AlP** from the ARS toolbar.

f. Work the initial P arrivals (refer to paragraph 3-393).

g. If possible, locate the event using arrival time information only (e.g., select **TimeDef** button to toggle **timedef** fields in the **AlphaList** to d, and the **azdef** and **slodef** fields to n).

h. Select **Algn P** from the ARS toolbar.

i. Scroll through the channels to check for missed detections (select **Show P** from the ARS toolbar to display the theoretical initial P arrival times for each site).

j. Predict for depth phases (refer to paragraph 3-414).

k. Predict for S phases (refer to paragraph 3-416).

l. Predict for later, non-defining short-period phases (refer to paragraph 3-418).

m. Locate event (refer to paragraph 3-389).

n. Select **OrAl** from toolbar (to display all associated arrivals).

o. Ensure all defining buttons are correct (**timedef, azdef, slodef, magdef**).

p. Finalize event location/solution.

q. Select **File⇒Save Single Origin** to save the origin and all associated arrivals to the output database.

r. Enter the appropriate comments (name, analyst position, etc.) in the **Edit Origin's Remarks** popup.

s. Select **Done**.

t. Repeat steps a. through s. for all events in the two-hour time block.

u. Work unassociated detections (refer to paragraph 3-422).

3-341. REGIONAL DATA ANALYSIS SEQUENCE.

3-342. This section provides a general outline of the analysis sequence for regional Spotlight processing.

a. Perform read data procedure as specified in paragraph 3-308.

b. Notify the SOM if an event is a Code 1, Code 2 or Code 3 (Codes are defined in the Center OI).

c. Check onset times and phase labels and edit as needed.

- - NOTE - -

In addition to a P-type phase (e.g., Pn or Pg) either an Sn or an Lg (or both) must be picked.

d. Let Px be the first arriving Pn or Pg phase.

e. Let Sx be the first arriving Sn or Lg Phase.

f. If both Sn and Lg exist, use the Lg time in the rules described in step g.

g. Use the following rules for choosing whether an event should be built. Build events in which the Sx time minus the Px time is related to the Px amplitude as follows:

(1) If Sx-Px time is less than 10, the Px corrected amp should be greater than 50.

(2) If Sx-Px time is between 10 and 12, the Px corrected amp should be greater than 35.

(3) If Sx-Px time is between 12 and 19, the Px corrected amp should be greater than 10.

(4) If Sx-Px time is between 19 and 27, the Px corrected amp should be greater than 5.

(5) If Sx-Px time is greater than 27, the Px corrected amp should be greater than 2.

- - NOTE - -

It may be necessary to beam separately for Sn, Lg, and Rg phases because the Px beam will not stack the energy of these other phases coherently.

h. If the event looks sufficiently large (using the rule-of-thumb described in step g.) pick onset times on the origin beam or the f-k beam.

i. Relocate using time and azimuth defining.

j. Do not use picks on individual elements to locate.

k. Use the **Measure** button to make an amplitude and period measurement on the f-k beam on the Pg arrival.

l. Save the event.

m. In a separate window, run automag on this event. This will calculate the regional magnitude.

n. Keep all events detected by the automatic system, regardless of the magnitude.

o. Delete detected and built events if their magnitude is less than 2.0.

p. Continue looking at all other events in the time block.

q. Scan all data looking for missed events.

r. Use the rules described above to decide if a missed event should be built. If so, use above procedures for building the new event.

s. When done, save unassociated detections, then exit.

3-343. BARM ANALYSIS PROCEDURES.

3-344. The purpose of Broad Area Regional Monitoring (BARM) analysis is to monitor seismic activity in a broad geographic region. This section provides a general outline analysis sequence for BARM.

a. Perform read data procedure as specified in paragraph 3-308, then in ARS select **File⇒Open⇒Latest Interval** for BARAL1.

b. In the pop-up menu enter an appropriate date/start time; all other parameters will default to the BARM account settings. This will activate the interval in the WorkFlow Pipeline (ARS BARAL1 should show as yellow).

c. Select an origin in the interval and depress the **ZAS** button in ARS. This will zoom to a one minute interval.

- - NOTE - -

To aid the analyst in refining events in the BARM region, the capability exists to display additional regional beams. Select a station/channel and in the ARS toolbar, select **Chans⇒Add Barm Channels**. *This will display an ihb beam, and an izb beam (all unfiltered) for the selected station. This beam set should assist the analyst in identifying the presence of Pn, Pg, Sn and Lg phases not detected by the automatic processing.*

d. Refine the origin using standard analysis procedures.

e. Save the origin using **File⇒Save⇒SaveSingleOrigin**.

f. Review additional origins in the interval and save as necessary.

g. Scan the unassociated detections as required to identify missed events.

h. Re-read the BARM interval using the NDCGLOB network. This will display the combined BARM and Global network station data in ARS.

i. Select each saved origin and **ZAS**. Review the global network stations for possible associations to the saved origins. Unfreeze origins as necessary to add new detections.

j. Run **Discrim** on origins as required by operational directives.

k. Save all data in the interval. Select **File⇒Save⇒SaveData**. This will activate the AUTO-BARAL1 interval in WorkFlow and run EvLoc.

3-345. LOOK-FORWARD ANALYSIS PROCEDURES.

3-346. The purpose of Look-Forward analysis is to validate that a given set of near real-time station associations (as specified in the Look Forward pipeline configuration) legitimately correlate to an event in the specified target area(s).

3-347. Perform read data procedure as specified in paragraph 3-308.

3-348. SEISMIC DATA ANALYSIS SEQUENCE.

a. This section provides a general outline of the analysis sequence for seismic Look-Forward processing. Detailed procedures for each of the steps are covered in separate sections.

b. Notify the SOM if an event is a Code 1, Code 2 or Code 3 (Codes are defined in the Center OI).

c. Work the highest priority, largest events first.

d. Select the desired event from the top of the ARS display.

e. Select **ZAS** from the ARS toolbar.

f. Select **AlP** from the ARS toolbar.

g. Work the initial P arrivals (e.g., retime). Refer to paragraph 3-393.

h. If possible, locate the event using arrival time information only (e.g., toggle **timedef** fields in the **AlphaList** to d, and the **azdef** and **slodef** fields to n).

i. Select **Algn P** from the ARS toolbar.

j. Scroll through the channels to check for missed detections (select **Show P** from the ARS toolbar to display the theoretical initial P arrival times for each site).

k. Predict for depth phases (refer to paragraph 3-414).

l. Predict for S phases (refer to paragraph 3-416).

m. Predict for later, non-defining short-period phases (refer to paragraph 3-418).

n. Locate event (refer to paragraph 3-389).

o. Select **OrAl** to display the alphanumeric information for all associated arrivals in the **AlphaList**.

p. Ensure all defining buttons are correct (**timedef, azdef, slodef, magdef**).

q. Finalize event location.

r. Select **File⇒Save Single Origin** to save the origin and all associated arrivals to the output database.

s. Enter the appropriate comments (e.g., name, analyst position) in the **Edit Origin's Remarks** popup.

t. Select **Done** in the lower left corner.

u. Repeat steps a. through t. for all events in the two-hour time block.

3-349. REGIONAL DATA ANALYSIS SEQUENCE.

3-350. Perform regional data analysis sequence procedure as follows:

a. Select event and **ZAS.**

b. Send to **AlphaList** using either the **AlP** or **OrAl** toolbar item.

c. Toggle the **timedef, azdef, slodef, magdef** flags in the **AlphaList** to the appropriate state.

d. Locate the event.

e. Send to Map to verify location.

f. **ZAS** to align data for the new origin location.

g. Work arrivals (e.g., retime, rename, add, predict).

h. Relocate, **ZAS**, send to Map**.**

i. Run ProcessOrid to compute new short-period and long-period origin beams.

j. Work arrivals, relocate the event, etc., as necessary.

3-351. HYDROACOUSTIC ANALYSIS.

3-352. Perform read hydroacoustic data procedure as follows:

a. Check with the SOM to verify that the assigned data interval is available.

b. Use the following steps to read data for a normal start-up (figure 3-57):

(1) Select the **File⇒Open⇒Latest Interval for Hydro** menu item/option in ARS.

(2) If the time block, network, and database listed in the resulting popup are correct, select **Done**.

(3) If the time block, network, and database listed in the resulting popup are not correct, enter the desired time block, network and/or database and then select **Done**.

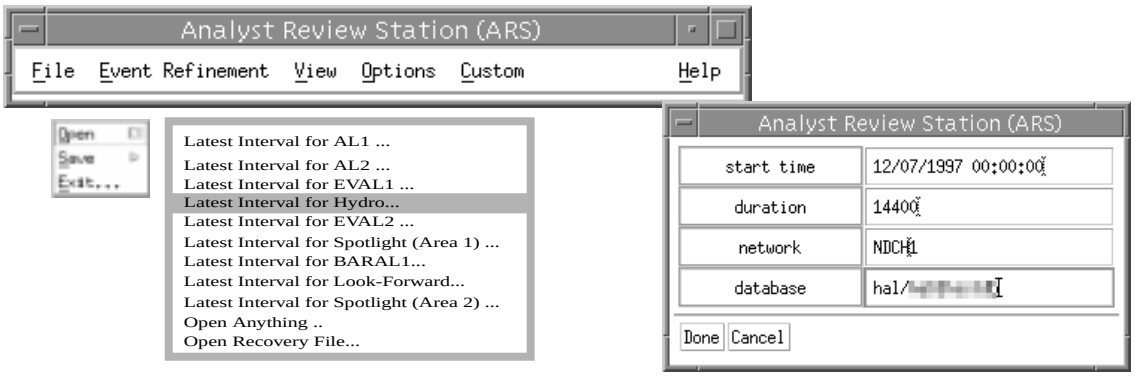

Figure 3-57. Reading Data for HAL Processing

c. Use the following steps to read data from the ARS recovery file (to recover the latest results after a crash) (see figure 3-58):

(1) In ARS, select the **File⇒Open⇒Open Recovery File**.

(2) The resulting popup should list the parameters appropriate for the time block that was being analyzed when the crash occurred.

(3) If the time, network, and database parameters are correct, select **Done**.

(4) If the time, network and database parameters are not correct, consult the SOM for further instructions.

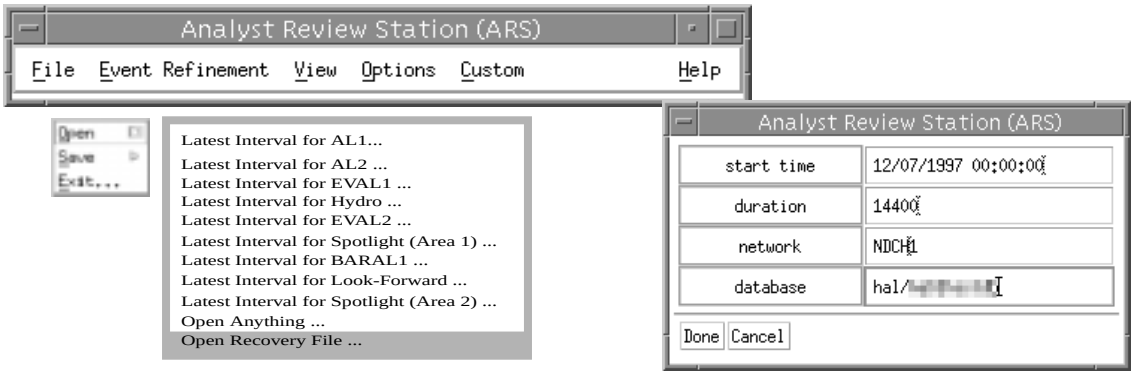

Figure 3-58. Reading Data from the ARS Recovery File

3-353. DATA ANALYSIS SEQUENCE.

3-354. Perform data analysis sequence procedure as follows:

a. Bring up two additional copies of each channel.

(1) Filter one copied channel between 5 Hz and 20 Hz.

(2) Filter the other copied channel between 20 Hz and 59 Hz.

(3) This produces one raw and two filtered waveforms for each channel.

b. Examine all automatically-detected signals and rename the phases to either G, N, T, or H as explained in steps (1) through (3).

(1) If the detection is an obvious glitch as evidenced by a gap or spike on the raw data channel, use the **AlphaList** to label the detection with a G.

(2) If the signal is less than one minute in duration or has the character of the background, use the **AlphaList** to label the detection with an N.

(3) If the signal has a duration of over one minute:

(a) Filter the signal with a high-pass filter (start with a 20 Hz filter).

(b) If there is no appreciable energy at the higher frequencies, label it with a T (for T-phase). T-phases are usually very emergent and tail off gradually.

(4) If the high-pass filtered signal contains significant energy in the 20 Hz to 59 Hz range relative to the energy in the 5 Hz to 20 Hz range, label it H, for direct hydroacoustic.

c. Retime automatically-picked phases as needed.

d. Look for undetected (e.g., unmarked) signals on the filtered trace where the maximum in the envelope is greater than four times the average noise background level.

e. If the signal is greater than one minute in duration:

(1) Mark the phase as either T (for T-phase) or H (for direct hydroacoustic).

(2) Use the above description to determine whether the signal is T or H.

f. If the signal is less than one minute in duration, do not mark a detection.

g. While analyzing hydroacoustic data, note any data quality problems in log files.

3-355. F-K ANALYSIS.

3-356. Most of the seismic stations in the NDC network consist of sensor arrays and/or multi-component sensors. These multi-channel data provide a sampling of the wavefield that spans both time and space. F-k analysis entails analyzing the temporal and spatial characteristics of a seismic wave as it sweeps across the sensor array. The signal's spatial and temporal characteristics can in turn be used to infer the signal's propagation direction, apparent propagation velocity, and/or wavetype.

3-357. SENDING ARRIVALS TO XFKDISPLAY.

3-358. Send arrivals to XfkDisplay as follows:

a. Select the arrival(s) to perform f-k analysis on (use the **<Shift>** plus select combination to choose multiple arrivals).

b. Popup activated when multiple arrivals are selected and the **FK** button is selected. Warns analyst that the multiple arrivals will be sent to XfkDisplay (figure 3-59).

c. Select the f-k item from the ARS toolbar.

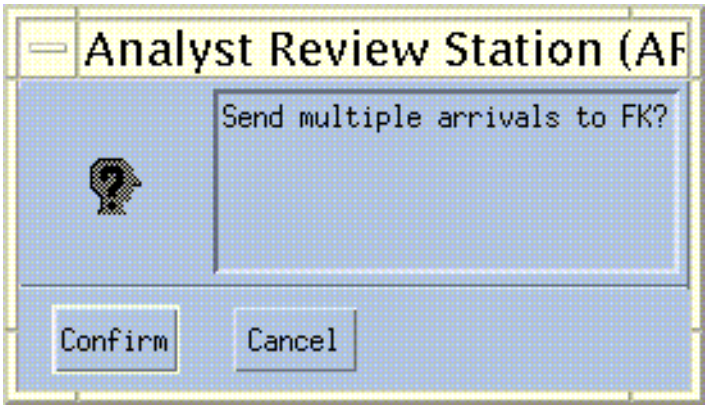

Figure 3-59. FK Warning

- - NOTE - -

If XfkDisplay was not launched previously, the analyst will experience a slight delay as XfkDisplay is launched and initialized prior to computing the f-k spectrum for the selected arrivals.

d. Move the cursor in the f-k power spectrum display to verify that the alphanumeric information listed in the main XfkDisplay window is valid/appropriate. For example, are the parameters listed in the main XfkDisplay window consistent with the values

associated with the peak in the f-k spectrum. If an origin was selected when the arrival was sent to f-k, an X will be plotted on the f-k spectrum to indicate the expected azimuth and slowness for the station, origin, and phase combination.

e. If the parameters are valid, select **Done**.

f. If the incorrect peak was selected:

(1) Select the correct peak/location in the f-k window.

(2) Select **Apply**.

(3) Select **Done**.

(4) If the f-k spectrum has other problems, follow the procedures in paragraph 3-359 and/or paragraph 3-361 to recompute the f-k spectrum.

g. Select **Send to ARS** to send the f-k parameters to ARS.

h. Select **Clear** to remove the f-k spectrum and associated alphanumeric information from the XfkDisplay window.

i. Select **Accept** to send the f-k information to ARS and clear the display.

j. Select **Beam** to send an f-k beam to ARS.

k. Select **Beam/Rot** from the XfkDisplay toolbar to send a three-component beam to ARS.

3-359. OVERRIDING THE DEFAULT FILTER SETTINGS.

3-360. In some situations it may be necessary or desirable to use a frequency band other than that specified in the default settings. The analyst can use/select a frequency band other than that specified in the default parameter files using the following procedure.

- - NOTE - -

It is important to remember the specified frequency band remains in effect for ALL subsequent f-k estimates until the analyst resets the filter parameters (see figure 3-60).

a. Select the **Filters** toolbar item from the XfkDisplay window.

b. Select the desired filter from the **Filter List** popup.

c. To use a frequency band other than one of those provided in the Filter List popup:

(1) Enter the desired lowpass and highpass frequency values in the **f-klof** and **f-khif** areas.

(2) Select **Apply** from the **Filter List** popup.

d. Select the **Calculate f-k** item from the XfkDisplay toolbar.

e. Select the **Display f-k** from the XfkDisplay toolbar.

f. Verify the alphanumeric information listed in the XfkDisplay window is valid by moving the cursor in the f-k power spectrum display.

g. If an origin was selected when the arrival was sent to XfkDisplay, an X will be plotted on the f-k spectrum to indicate the expected azimuth and slowness for the current station, phase, and origin combination.

h. If the parameters are valid, select **Done**.

i. If the incorrect peak was picked:

(1) Select the correct peak/location in the f-k window.

(2) Select **Apply**.

(3) Select **Done**.

j. If the f-k spectrum has other problems, follow the procedures in paragraph 3-359 and/or paragraph 3-361 to recompute the f-k spectrum.

k. Select the **Send to ARS** to send the f-k parameters to ARS.

l. Select **Clear** to remove the f-k spectrum and associated alphanumeric information from the XfkDisplay window.

Figure 3-60. Overriding the Default f-k Filters

3-361. EXCLUDING CHANNELS FROM F-K ANALYSIS.

3-362. There may be times when noisy channels and/or channels with glitches or spikes degrade and/or cause misleading f-k results. There are two procedures for excluding bad data channels from f-k analysis (see figure 3-61).

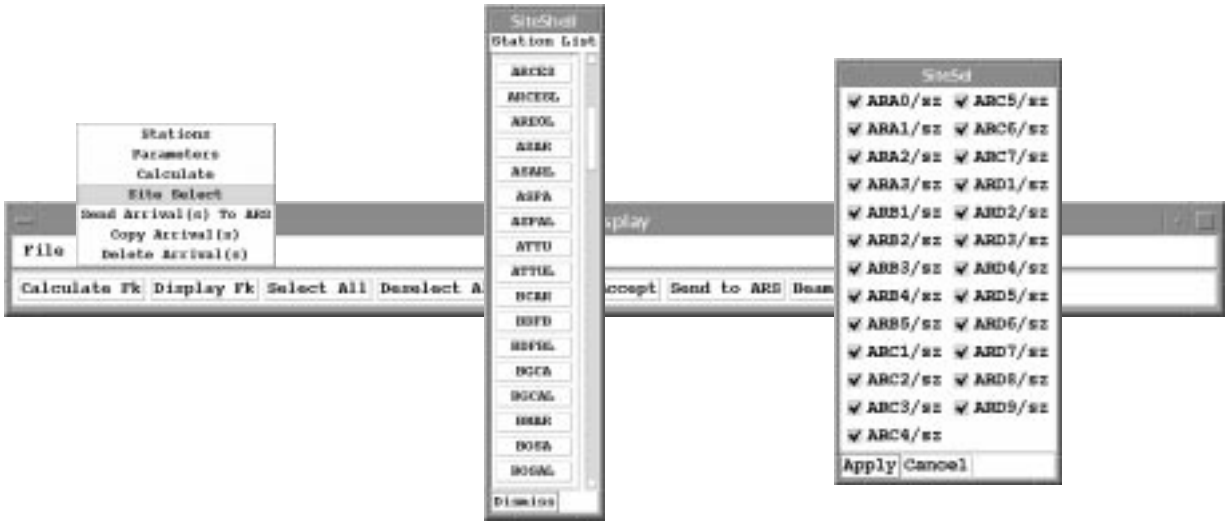

Figure 3-61. Excluding Channels from f-k Analysis

3-363. The first procedure entails selecting bad data channels in ARS prior to sending the arrival for f-k analysis. The list of bad channels specified in this way is temporary; subsequent f-k analysis will not exclude the channels specified in this way. The procedure is as follows:

a. Select the desired station/arrival pair for f-k analysis.

b. Use the **<Shift>e** keystroke combination to display the raw data for each of the array elements.

- - NOTE - -

The **<Shift>** *plus select combination must be used to insure that both the station and the bad channels are sent to the XfkDisplay algorithm.*

c. Scroll through the data and use the **<Shift>** plus select combination to select the individual channels that should be excluded from f-k analysis.

d. Select the **f-k** button from the ARS toolbar and follow the procedures in paragraph 3-357 to verify the f-k results and send them to ARS.

- - NOTE - -

Automatic processing routinely checks for spikes and gaps. Thus the results may not differ from the automatic processing results after editing the channels used for f-k analysis.

e. When the f-k analysis is finished, use the **<Shift>u** keystroke combination to remove the raw data for each of the station's elements from the ARS display.

3-364. The second approach for excluding channels from f-k analysis is invoked from XfkDisplay. This method for excluding channels differs from the previous method in that the excluded channels will be neglected in subsequent f-k computations for that station until they are turned back on.

a. Select the desired station/arrival pair for f-k analysis.

b. Use the **<Shift>e** keystroke combination to display the raw data for each array element.

c. Select the **Edit⇒Site Select** menu/option in the XfkDisplay window.

d. Select the appropriate station from the **Station List** popup.

e. In the resulting channel popup, uncheck the elements that should be excluded from f-k analysis.

f. Select **Apply**.

g. Remove the **Station List** from the display by selecting **Dismiss**.

h. Select **Calculate f-k** from the XfkDisplay toolbar.

i. Select **Display f-k** from the XfkDisplay toolbar.

j. Follow the normal f-k analysis procedures listed in paragraph 3-355.

3-365. F-K ANALYSIS FOR THREE-COMPONENT SENSORS.

3-366. The NDC network includes isolated three-component sensors, and three-component sensors that account for one or more of the elements in a sensor array. To perform f-k analysis using data from a three-component sensor:

a. Select the desired station/arrival pair for f-k analysis.

b. Select the **f-k** button from the ARS toolbar.

c. Manipulate f-k results as normal.

3-367. BEAMFORMING.

3-368. Beamforming is the process of combining multiple channels to produce a single output channel that enhances a signal with particular spatial and temporal characteristics.

3-369. EVENT BEAMS.

3-370. Event beams are computed by summing the array elements after applying the delays consistent with the theoretically derived azimuth and apparent velocity for a specified source/station/phase combination. Analyst-created event beams are labeled sta/szb-nn, where sta is the station ID and nn is a count. The steps for creating an event beam are as follows:

a. Select the desired origin.

b. Select the site to compute event beam(s) (use the **<Shift>** plus select combination to select multiple sites).

c. Select **Beam** from the ARS toolbar.

d. From the **Select Phases** popup, select the phase(s) to compute an event beam for and then select **OK**.

e. A **Processing** popup will appear while DFX is computing the appropriate beams.

f. When DFX is finished, the origin beams, labeled sta/szb-nn, will be displayed below the station channel.

3-371. EXCLUDING CHANNELS FROM EVENT BEAMS.

3-372. Noisy channels and channels with data glitches or spikes can degrade the beam quality and/or lead to results that are misleading. Use the following procedure to exclude bad data channels from event beams:

a. Select the desired origin.

b. Select the station to beam.

c. Use the **<Shift>e** keystroke combination to display the data for the individual array elements.

d. Scroll through the elements and use the **<Shift>** plus select combination to select the channels to exclude from the event beam.

e. The **<Shift>** plus select combination must be used to insure that both the array site ID and the individual element IDs are included in the message sent to the beamforming algorithm.

f. Select **Beam** from the ARS toolbar.

g. From the **Select Phases** popup, select the phase(s) to compute an event beam for, and then select **OK**.

h. A **Processing** popup will appear while DFX is computing the appropriate beams.

i. When DFX is finished, the origin beams, labeled sta/szb-nn, will be displayed below the station channel.

j. Use the **<Shift>u** keystroke combination to remove the individual array elements from the ARS display when beamforming is finished for that site.

3-373. F-K BEAMS.

3-374. The f-k beams represent a combination of the data from the individual array elements after each observation has been shifted to account for the travel time delay experienced by that array element for a signal traveling with a specified direction and apparent velocity inferred from f-k analysis. Assuming data availability, f-k beams can be computed using the following procedure:

a. Select the detection to compute an f-k beam for, or use the **<Shift>** plus select combination to select multiple detections.

b. Select **Beam** from the ARS toolbar.

(1) This will initiate XfkDisplay and compute the corresponding f-k beam(s).

(2) The beam(s) will be labeled sta/fkb-nn and displayed below the associated station in the ARS display.

c. Refer to paragraph 3-355 for instructions on how to verify and/or modify the f-k parameters and recompute the associated beam.

3-375. EXCLUDING CHANNELS FROM F-K BEAMS.

3-376. Noisy channels and channels with spikes can degrade the quality of an f-k beam and/or lead to misleading/erroneous results. Bad data channels can be excluded from the f-k beam using two different procedures (see figure 3-62).

3-377. The first procedure involves selecting the channels to exclude from the ARS display as is done for event beams. The procedure is as follows:

a. Select the arrival for which to compute an f-k beam.

b. Select the associated array site.

c. Use the **<Shift>e** keystroke combination to display the data for the individual array elements.

d. Scroll through the elements and use the **<Shift>** plus select combination to select the elements to exclude from the f-k analysis and f-k beam.

- - NOTE - -

The **<Shift>** *plus select combination must be used to insure that both the array station and the individual bad channels are included in the message sent to the beamforming algorithm. Proceed with the beam-forming procedure.*

e. Use the **<Shift>u** keystroke combination to remove the individual elements from the ARS display after f-k analysis and beam production are finished.

3-378. The second procedure for excluding bad data channels from the f-k beams involves selecting excluded channels within XfkDisplay.

a. Start XfkDisplay from dman or from ARS (**FK** or **Beam**).

b. Select the **Edit⇒Site Select** popup (see figure 3-62).

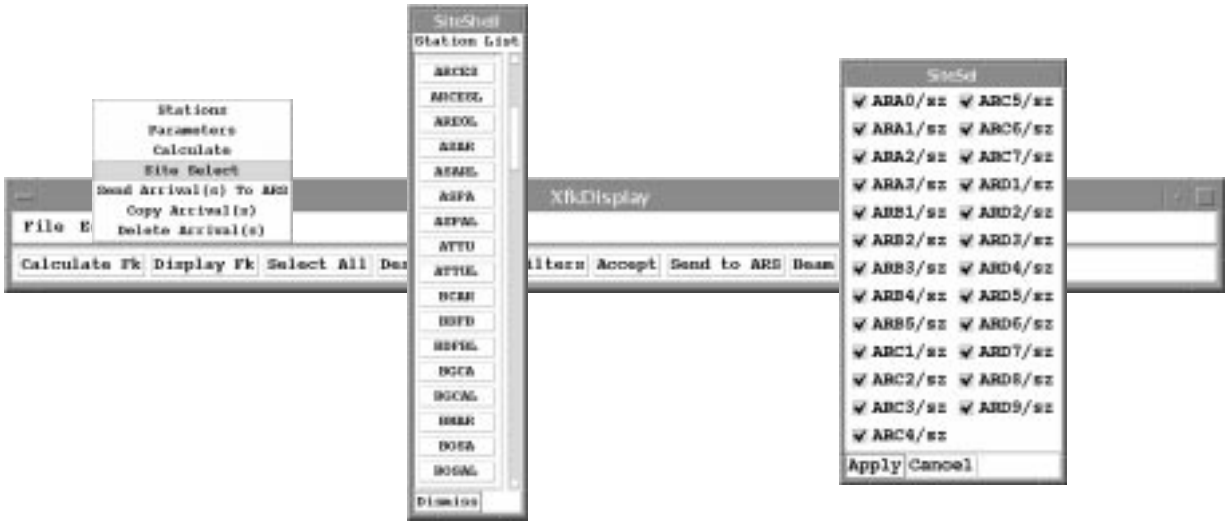

Figure 3-62. Excluding Channels from f-k Beams

c. Select the site.

d. When the channel selection popup appears, uncheck the desired boxes to remove channels from f-k analysis.

e. The changes will remain until reset or until XfkDisplay is killed and restarted in a session.

f. Proceed with beam formation after selecting the channels to exclude.

3-379. F-K AND EVENT BEAMS FOR THREE-COMPONENT SENSORS.

3-380. The NDC network includes both isolated three-component sensors and three-component sensors that account for one or more of the elements in a sensor array.

a. Use the following procedure to compute an event beam(s) for a three-component sensor(s):

(1) Select the desired origin.

(2) Select the station to compute an event beam for, or the **<Shift>** plus select combination to select multiple stations.

(3) Select **Beam** from the ARS toolbar.

(4) From the **Select Phases** popup, select the phase(s) to compute an event beam for, and then **OK**.

(5) A **Processing** popup will appear while DFX is computing the appropriate beams.

(6) When DFX is finished, the origin beams, labeled sta/szb-nn, will be displayed below the selected station(s).

b. Use the following procedure to compute an f-k beam(s) for a three-component sensor(s).

(1) Select the detection to compute an f-k beam for, or the **<Shift>** plus select combination to select multiple detections.

(2) Select **Beam** from the ARS toolbar. This will initiate XfkDisplay and compute the corresponding f-k beam(s). The beam(s) will be labeled sta/fkb-nn and displayed with the associated station in the ARS display.

(3) Refer to paragraph 3-355 for instructions on how to verify and/or modify the f-k parameters and recompute the associated beam.

3-381. COMPUTING BOTH EVENT AND F-K BEAMS.

3-382. Event and f-k beams can be computed simultaneously. If the selection list contains an origin, one or more stations, and one or more detections when the **Beam** toolbar item is selected, both origin and f-k beams will be computed for the selected origin/station/detection items.The procedure for these computations is as follows:

a. Select the detections for f-k beaming: select one or more detections using the **<Shift>** plus select combination to select multiple detections.

b. Select origins and stations for Event beams:

(1) Keeping the **<Shift>** key down, select an origin.

(2) Keeping the **<Shift>** key down, select one or more stations.

(3) Select the phases for which to compute event beams.

(4) Select **Beam** from the ARS toolbar.

3-383. ROTATING HORIZONTAL CHANNELS.

3-384. The horizontal data channels from a three-component sensor can be manipulated to enhance horizontally polarized phases such as S and PS. The resulting components are referred to as the (rotated) radial and transverse components; the rotation is with respect to the back-azimuth to the source. Data channels can be rotated using the following procedure:

a. Select a single origin.

b. Select a single site, or the **<Shift>** plus select combination to select multiple sites.

c. Select the **Rot** button from the ARS toolbar.

d. Select a phase from the **Select Phases** popup, and then **OK** from the lower left corner.

e. The resulting radial and transverse channels will be labeled sta/srb-nn and sta/stb-nn, respectively, and displayed below the selected channel(s).

3-385. SAVING ANALYST CREATED BEAMS.

3-386. The automatic processing which occurs between the stages of interactive analysis will compute f-k beams for detections which do not have beams. The analyst does, however, have the option of saving event and/or f-k beams created during an interactive analysis session.

a. Use the following procedure to save a detection/f-k beam:

(1) Select the sta/chan corresponding to the beam to save.

(2) Select the detection associated with the selected beam.

(3) Use the **<Control>b** keystroke combination to save the beam; the original/previous f-k beam will be deleted.

b. Use the following procedure to save an origin beam:

(1) Select the sta/chan corresponding to the beam to save.

(2) Select the origin associated with the selected beam.

- - NOTE - -

If both an origin and a detection are selected when the save-beam function is invoked, the beam will be saved as a detection beam.

(3) Use the **<Control>b** keystroke combination to save the beam. The original/previous origin beam will be deleted.

3-387. COMPUTING EVENT LOCATIONS AND MAGNITUDES.

3-388. Event locations and magnitudes are computed in conjunction with each other. While the event magnitude has no effect on the event location, the event location has a direct effect on the magnitude estimate.

3-389. EVENT LOCATION.

3-390. Use the following procedure to locate events:

a. Select the event to locate.

b. Select the **OrAl** item from the ARS toolbar.

(1) This will display the alphanumeric information for the selected origin and all of its associated arrivals in the **AlphaList**.

(2) Selecting the **AlP** item from the ARS toolbar will send the origin and its associated initial P arrivals (only) to the **AlphaList**.

c. Verify that the desired detections are time defining (i.e., the **timedef** field in the **AlphaList** should be toggled to d). If possible, the event should be located using only arrival time information (e.g., the azdef and slodef fields in the **AlphaList** should be toggled to n).

d. Select **Locate** from the **AlphaList** toolbar, **Loc** item from the ARS toolbar, or by using the **<Control>l** keystroke combination.

e. The location algorithm will initiate (or update) both the **Locator** and **Magnitude** dialogs.

f. Select the preferred origin from the Locator Dialogue.

g. If the location is problematic:

(1) Toggle bad observations to non-defining.

(2) Toggle good observations to azdef/slodef.

(3) Use the ARS's **Event Refinement⇒Locator Options⇒Set Locator Iterations** item to (re)set the number of iterations.

(4) Exercise the options provided by the Locator Controls GUI accessed by selecting the **Controls** button in the Locator Dialogue.

3-391. EVENT MAGNITUDES.

3-392. Event magnitudes are computed in conjunction with event locations. The event magnitude is determined by the event location, amplitude, and period of the arrivals that are identified as magnitude defining. A change in the event location will have a direct effect on the event magnitude, as will toggling any of the arrivals from magnitude defining to non-defining, and/or changing the amplitude/period measurement for any of the magnitude defining phases.

3-393. WORKING ARRIVALS.

3-394. The following procedures are used for adjusting and/or adding detections. Correct timing and phase identification are crucial to an accurate/valid source location. All start times MUST be measured using the default filters which are:

a. For USAEDS stations, a 0.4 3.5 Hz, three-pole, non-causal bandpass filter (specified by the 0.4 3.5 3 BP non-causal string).

b. For ASN stations, a 0.8 3.5 Hz, three-pole, non-causal bandpass filter (specified by the 0.8 3.5 3 BP non-causal string).

3-395. ASSOCIATING DETECTIONS.

3-396. The following procedure should be used to associate arrivals with the currently selected origin. If the arrival is currently associated to another origin, it will be automatically disassociated from that origin prior to being associated to the currently selected origin. With experience, the analyst may forego several of the following steps.

a. Select the desired arrival (use the **<Shift>** plus select combination to select multiple arrivals).

b. Use the **<Control>a** keystroke combination to send/display the selected arrivals' alphanumeric in the **AlphaList**.

c. To verify that the selected arrival(s) are associated with the selected origin, consult the appropriate parameters in the **AlphaList** (e.g., compare the f-k azimuth in the **AlphaList** and the azimuth listed below the sta/chan in ARS).

d. Send the selected origin and arrival(s) to Map and/or perform f-k analysis on the selected arrival(s).

e. Use the **<Control>s** keystroke combination to associate the selected arrival(s) with the selected origin.

3-397. RETIMING DETECTIONS.

3-398. Perform retiming detections procedure as follows (figure 3-63):

a. Select the desired arrival.

b. In the selected arrival's waveform window, use the middle mouse button (depress and move) to adjust the t1 time marker.

- - NOTE - -

Popup activated in ARS when an arrival is retimed more than two seconds and less than five seconds. Warning message indicates that measurements/ magnitudes are no longer valid and that arrivals MUST be remeasured.

c. Use the **<Control>t** keystroke combination to adjust the selected arrival's onset time.

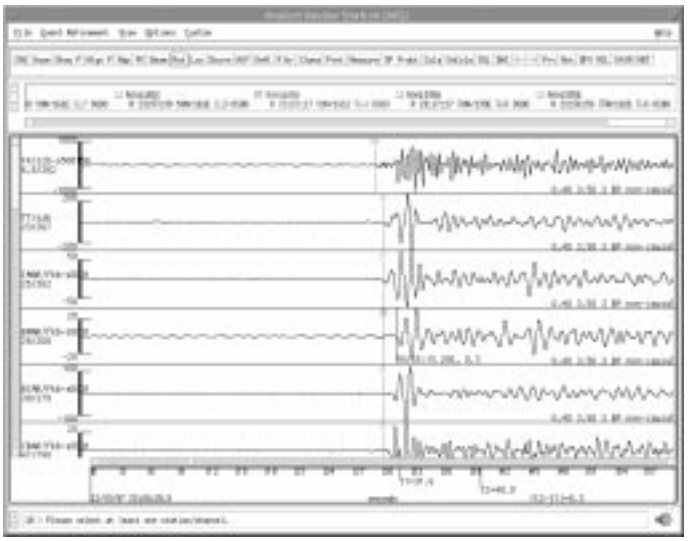

Figure 3-63. Phase Retiming

3-399. RENAMING DETECTIONS.

3-400. Perform renaming detections procedure as follows (figure 3-64):

a. Select the desired arrival (use the **<Shift>** plus select combination to select multiple arrivals).

b. Use the **<Control>n** keystroke combination to activate the **Select a Phase** popup.

c. Select the desired phase name, and then **OK** from the lower left corner of the **Select a Phase** popup.

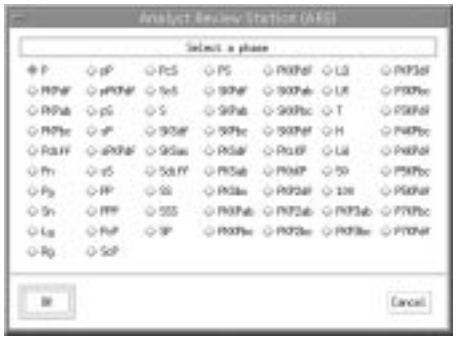

Figure 3-64. The Select a Phase Popup Window

3-401. DISASSOCIATING DETECTIONS.

3-402. Use the following procedure to disassociate arrivals from the currently selected origin:

a. Select the arrival to disassociate (use the **<Shift>** plus select combination to select multiple arrivals).

b. Before disassociating the selected arrival(s) from the selected origin:

(1) Verify that the arrival(s) are not in fact associated with the origin.

(2) Use the **<Control>a** keystroke combination to send/display the selected arrivals' alphanumeric in the **AlphaList**.

(3) Compare the f-k azimuth in the **AlphaList** as well as the azimuth listed below the **sta/chan** in ARS.

(4) The arrivals can, alternatively, be sent to Map and/or XfkDisplay.

c. Use the **<Control>d** keystroke combination to disassociate the selected arrival(s) from their respective origins.

3-403. DELETING DETECTIONS.

CAUTION

Exercise caution when deleting detections. In some cases it may be more prudent to simply disassociate the arrival from the origin. The apparently erroneous detection may be an erroneously associated defining phase for a different origin.

a. Select the arrival to delete (use the **<Shift>** plus select combination to select multiple arrivals).

b. Use the **<Control>x** keystroke combination to delete the arrival(s).

3-404. CREATING DETECTIONS.

3-405. Use the following procedures to add detections:

a. Select the desired sta/chan.

b. Click the middle mouse button (depress and move) in the selected channel's waveform window to adjust the time marker to the appropriate time.

c. Use one of the following options to add an arrival:

(1) Use the **<Control>p** keystroke combination to add a P detection.

(2) Use the **<Shift>p** keystroke combination to add a detection with the current phase ID. The current phase ID is the phase specified for the most recent channel-alignment-by-phase, name change, or created detection.

(3) Use the **<Control>0** (zero) keystroke combination to add a pP detection.

(4) Use the **<Control>y** keystroke combination to add an LR detection.

(5) Use the **<Control>q** keystroke combination to add an LQ detection.

(6) Use the **<Control>v** keystroke combination to select a phase name from the **Select a phase** popup (the phase ID can also be manipulated/changed by editing the appropriate field in the **AlphaList**).

d. XfkDisplay will be invoked to compute the f-k parameters for each added detection. Follow the procedures in paragraph 3-355 to verify/adjust the f-k parameters and, if necessary or desired, compute the associated f-k detection beam.

3-406. MAKING AMPLITUDE AND PERIOD MEASUREMENTS.

3-407. The following operations are used to verify and adjust amplitude and period measurements. Correct amplitude and period measurements are crucial for accurate source magnitudes (the A5/2 measurement, made on the initial P arrival at each site, for mb and the ALR/2 measurement, made on each site's lzb channel, for ms).

a. All short-period amplitude and period measurements must be made using the following filter settings:

(1) For USAEDS stations, a 0.5-3.5 Hz three-pole, non-causal bandpass filter (specified by the 0.5 4.0 3 HP non-causal string).

(2) For ASN stations, a 0.8 -3.5 Hz, three-pole, non-causal highpass filter (specified by the 0.8 4.0 3 HP non-causal string).

(3) The short-period filters can be toggled on/off using the **<Shift>m** keystroke combination.

b. All long-period amplitude and period measurements must be made using the following filter settings:

(1) 0.03 to 0.07 Hz, three-pole, non-causal bandpass filter (specified by the 0.03 0.07 3 BP non-causal string).

(2) The long-period filters can be toggled on/off using the **<Shift>l** keystroke combination.

c. The current procedures are for the analyst to make amplitude and period measurements only for the initial P arrival and the LR arrival. The amplitude and period measurements for other detections will be made in the automatic pipeline precedes event classification.

3-408. MAKING MEASUREMENTS MANUALLY.

3-409. Short-period amplitude and period measurements for the initial P arrivals are reviewed, corrected and added using the following procedure:

a. Select the **Measure** item from the ARS toolbar. Measure will:

(1) Zoom to a 20-second window aligned on the initial P arrivals for the selected origin.

(2) Apply the appropriate measurement filter.

(3) Display the time markers denoting the time period over which the amplitude and period measurements were made.

b. To adjust an amplitude/period measurement, select the desired detection.

c. Use the right mouse button (depress and move) to adjust the time marker to the appropriate peak/trough.

d. Use the right mouse button (depress and move) to adjust the time marker to the following peak/trough. While moving the cursor with the right mouse button depressed, a box (and the corresponding alphanumeric) will appear denoting the amplitude and time limits corresponding to the amplitude/period measurements.

e. After reviewing all initial P amplitude/period measurements for the selected origin, ARS can be returned to its original display by selecting the **Measure** item from the ARS toolbar.

3-410. For cases where the amplitude/period measurements for short-period phases other than the initial P are being reviewed:

a. Select **View⇒Align Channels⇒Align Designated**.

b. Select the desired phase from the **Select a Phase** popup, then **OK**.

c. Perform measurements the same as for initial detections.

3-411. USING DFX TO MAKE MEASUREMENTS.

3-412. DFX can be invoked interactively using the following procedure:

a. Select the arrival to send to DFX (use the **<Shift>** plus select combination to select multiple arrivals).

b. Select the **DFX RCL** item from the ARS toolbar. A **Processing** dialog will appear while DFX is making the measurements.

c. On completion, DFX will return the measurements to ARS. The appropriate fields in the **AlphaList** will be updated to reflect the new measurements.

3-413. PHASE PREDICTION.

3-414. PREDICTING DEPTH PHASES.

3-415. Depth phases (e.g., pP, sP, pPKPdf) provide both valuable constraints on source depth and information used in event classification.

- - NOTE - -

The depth phase's amplitude and period measurements should not be made using the direct phase's beam.

a. Select **View⇒Align Channels⇒Align Theoretical** from ARS.

b. Select the desired phase from the **Select a Phase** popup.

c. Select **OK**.

d. Adjust existing detections and/or add new detections where appropriate.

e. Select the **OrAl** item from the ARS toolbar to display the newly added depth phase information in the **AlphaList**.

f. Adjust the **timedef**, **azdef**, **slodef** fields as needed and relocate the event.

3-416. PREDICTING HORIZONTAL PHASES.

3-417. Use the following procedure to predict and enhance the data for horizontally polarized arrivals.

a. Select the origin for which to predict horizontal phases.

b. Select **ViewAlign Channels⇒Align Theoretical** from ARS.

c. Select the desired phase from the **Select a Phase** popup.

d. Select **OK**.

e. Select the sites whose horizontal channels are to be rotated to enhance horizontally polarized arrivals (use the **<Shift>** plus select combination to select multiple sites).

f. Select the **Rot** button from the ARS toolbar.

g. Select the desired phase from the **Select a Phase** popup.

h. Select **OK**.

i. A **Processing** dialog will appear while the channels are being rotated. On completion, the rotated data channels will be displayed in ARS with sta/srb-nn and sta/stb-nn labels (for origin radial and transverse beams, respectively).

j. Adjust existing detections and/or add new detections where appropriate.

- - NOTE - -

The automatic processes that occur between the interactive processing stages will not rotate data for short-period arrivals. Follow the procedures in paragraph 3-385 to insure that the rotated beams associated with the desired short-period, horizontally polarized phases get saved.

3-418. PREDICTING LATER, NON-DEFINING PHASES.

3-419. Use the following procedure to predict later, non-defining phases:

a. Select **SP Prdct** from the ARS toolbar.

b. Select the desired list (based on the size of the event) from the resulting selection popup, and select then **Done**. The three list options are:

(1) The short-list includes pP, PKPab, PcP, ScP, PP, S, PKKPab, PKKPbc, and PKKPdf.

(2) The long list includes all the phases in the **Select a Phase**(s) menu invoked.

c. Select **SP Prdct** from the ARS toolbar. This will align the data on the first phase in the selected list.

d. Associate, rename, retime, etc. existing detections, and/or create detections as needed.

e. Select **SP Prdct** from the ARS toolbar to align the data on the next phase in the selected list of phases.

f. Repeat the **SP Prdct**, associate, and/or add detections sequence until the **End of theoretical list** message appears in the text window at the bottom of the ARS**.**

g. To exit **SP Prdct**, reselect the origin, save the origin, or predict for long-period phases as described in paragraph 3-420.

3-420. LONG PERIOD DETECTIONS.

3-421. Perform long period detections as follows:

a. Select the origin for which to predict/work long-period phases.

b. Select **View⇒Later Phases⇒LP Phases** menu from ARS. The ARS display:

(1) Will be adjusted to display the lzb and ltb channels.

(2) Mark the theoretical LR and LQ arrival times.

(3) Align the channels on the theoretical LR arrivals.

c. Use the following procedure to add an LR detection:

(1) Select the lzb channel to add an LR detection.

(2) Use middle mouse button (depress and move) in that channel's waveform window to adjust the time marker to the center of the appropriate cycle.

(3) Use the **<Control>y** keystroke combination to add an LR detection at the selected time. ARS will:

(a) Measure the amplitude and period of the cycle selected (the arrival's time will be adjusted to lie between the appropriate peak and trough).

(b) Send the arrival to XfkDisplay.

(c) Follow the procedure in paragraph 3-355 to verify the f-k parameters and send them to ARS.

(4) If the measured period is not within the 18 second to 24 second period range, the detection is considered an invalid LR pick (see figure 3-65).

(5) If the LR detection is invalid, delete it using the **<Control>x** keystroke combination and add another LR detection at the appropriate time.

(6) If the automatic period determination is not working properly, adjust the period using the procedures in paragraph 3-406.

(7) When finished reviewing the long-period data, select **View⇒Later Phases⇒Return** to return the ARS display to its previous/non-long-period state (selecting **ZAS** will reset the measure variable).

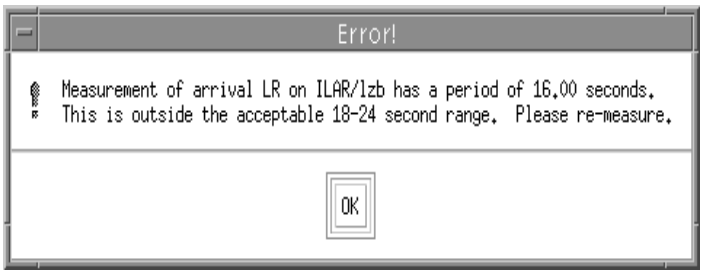

Figure 3-65. Invalid LR Detection

d. Use the following procedure to add an LQ detection:

(1) Select the ltb channel to add an LQ detection.

(2) Click the middle mouse button (depress and move) in that channel's waveform window to adjust the time marker to the center of the appropriate cycle.

(3) Use the **<Control>q** keystroke combination to add an LQ detection at the selected time.

(4) If the automatically measured period is not correct, adjust the period using the procedures in paragraph 3-408.

(5) When finished reviewing the long-period data, select **View⇒Later Phases⇒Return** to return the ARS display to its previous/non-long-period state (selecting **ZAS** will reset the measure variable).

3-422. WORKING UNASSOCIATED DETECTIONS.

CAUTION

Do not work any origins or unassociated arrivals that fall outside of the assigned two-hour time block, the exception being when unassociated arrivals that fall outside of the assigned two-hour time block can be associated to an origin that falls within that two-hour time block. (The time listed at the far left in the time scale window indicates the time at the far left of the ARS waveform window(s). Time can also be obtained by clicking the middle mouse button in any of the waveform windows.)

3-423. An important point to remember is that when working unassociate detections, the two-hour time block includes three hours of data as:

a. A half-hour preceding the two-hour block of interest;

b. The two-hour block of interest; and

c. A half-hour following the two-hour block of interest.

3-424. REVIEWING UNASSOCIATED DETECTIONS.

3-425. Review unassociated detections as follows:

a. Select the **Chans** button from the ARS toolbar.

b. Select **Unassoc Detects** from the popup, and then **Done.** The ARS display:

(1) Will adjust to show the first minute of data in the two-hour time block.

(2) Sort the channels according to the default sort specification.

c. Use the **Prv** and **Nxt** buttons on the ARS toolbar to scroll through the list of unassociated detections. ARS will:

(1) Scroll in time to display the previous (**Prv**) or next (**Nxt**) unassociated detection.

(2) Sort the channels according to the default sort specification.

d. Follow the procedures in paragraph 3-393 to retime, rename, delete, etc., phases as necessary.

e. Send interesting arrival(s) to the **AlphaList**, Map and/or XfkDisplay to determine whether or not they are potential defining phases for a missed event.

f. Follow the procedures in paragraph 3-422 to define/build a new event/origin using unassociated detections.

g. After reviewing the final unassociated detection in the two-hour time block (remember that data includes a half-hour preceding and a half-hour following the two hours of interest), select the **File⇒Save Data** menu item/option. This will:

(1) Save the remaining unassociated detections (in the two-hour time block) to the output database.

(2) Initiate the automatic processing that precedes the next stage of interactive analysis.

3-426. BUILDING MISSED EVENTS.

3-427. The two convenience functions and toolbar items for building missed events/origins (using unassociated detections) are **COL** and **COLA**. The COL of both function is an acronym for Create Origin and Locate. **COL** does simply that; it creates a new orid and attempts to locate the event using the selected detections. **COLA** includes the following additional procedures:

a. Sort the channels with respect to the distance from the new origin.

b. Align the channels on the observed (or theoretical) initial P arrivals.

c. Send the detections (both associated and unassociated) that fall within a five minute window surrounding the initial P arrival to the **AlphaList**.

d. Send the detections and new origin to Map.

- - NOTE - -

Because **COLA** *modifies the time alignment scheme/state (from unaligned to aligned on observed/theoretical), the* **UnCOLA** *button must be selected to return ARS to the unaligned state prior to continuing with* **Prv** *and/or* **Nxt.**

3-428. If **COL** (or **COLA**) is successful, the analyst can use the **GAIM** toolbar item to invoke the same association algorithm used during automatic processing to search for additional corroborating detections. Using **COL** and **COLA**:

a. Select the detection(s) to associate and use to define the source location.

b. Select **COL** or **COLA** from the ARS toolbar.

c. If an event is formed, follow the normal procedures for working an event/ refining an event location/solution (including predicting additional defining, depth, and short-period horizontal phases).

d. If **COL** fails:

(1) Send the selected arrivals to Map by selecting **Map** from the ARS toolbar (**COLA** includes commands to send the selected detections to Map).

(2) The source/receiver paths inferred from the detections' azimuth and slowness information will be displayed on Map; these paths provide, in essence, the single-station location associated with each detection.

e. In Map, move the cursor to the location inferred from the best detection, or a location that is consistent with multiple detections.

f. Right-click to select the location, then left-click the **Lat/Lon** button from the Map toolbar. The latitude and longitude of the selected point/location will be displayed.

g. In the **Locator Constraint Controls** section of the Locator Dialogue, select the **Lat** button and enter the coordinates from Map's **Information** dialog popup as well as the **Depth** button to constrain the depth to the surface.

h. Select **OK** from the Map **Information** dialog to remove the latitude and longitude information from the Map display.

i. Select the **Locate** button from the Locator Dialogue.

j. Select the **Pref** button next to the restrained solution (Run = R) from the upper part of the Locator Dialogue.

k. Select **ZAS** from the ARS toolbar to align the data on the observed/theoretical initial P arrivals for the new origin.

l. If any detections appear to be consistent with the origin:

(1) Select them using the **<Shift>** plus select mouse button combination.

(2) Associate them to the origin using the **<Control>s** keystroke combination, and relocate.

m. If it is not possible to define an event location or solution, delete the origin using the **<Control>e** keystroke combination; this will delete only the origin, not any associated detections.

n. If **COLA** was originally selected from the ARS toolbar, remember to select **UnCOLA** to revert the time alignment scheme to the unaligned state prior to moving to the next or previous unassociated detection using the **Nxt** or **Prv** toolbar items.

3-429. USING GA TO SEARCH FOR CORROBORATING ARRIVALS.

- - NOTE - -

GAIM *will not use any detection that does not have a valid Orid assigned to it. If a new detection is added to a* **GAIM** *built event DFX recall* must be *run on it before* **GAIM** *will use the detection in the locator calculation.*

3-430. If **COL** (or **COLA**) is successful, the analyst can use the ARS **GAIM** toolbar item to initiate a search for corroborating detections using the same association algorithm used during automatic processing. Use the following procedure to invoke Global Association (GA) to search for corroborating arrivals:

a. Select the origin for which to search for corroborating detections; the origin should not be frozen.

b. Select **GAIM** from the ARS toolbar. A **Processing** dialog will appear while GA is working.

c. If GA finds additional corroborating detections (the list of potential corroborating phases passed to GA includes only unassociated detections), it will:

(1) Automatically associate those detections to the origin, and relocate the origin.

(2) Return the new origin solution to ARS.

d. If GA does not find any additional corroborating detections, the `No origins returned from GAIM.` message will appear in the text/message window at the bottom of ARS

e. If GA returns a new origin solution, follow the procedures in paragraph 3-387 and paragraph 3-393 to refine and finalize the event solution.

3-431. RUNNING PROCESSORID.

3-432. Use the following procedure to run ProcessOrid:

a. Verify that the event to compute origin based beams/measurements for has been saved to the output database (e.g., the event is frozen).

b. ProcessOrid can be invoked from an xterm using the **Engage ProcessOrid** command, or can be selected from the analyst's **Application Menu** as follows:

(1) Place the cursor on the desktop background (e.g., outside of all windows).

(2) Press the select mouse button and select **NDC Applications**.

(3) Select the **ProcessOrid** item from the **NDC Applications** popup.

c. In the **ProcessOrid** window, enter the appropriate database. The database can be selected by placing the cursor on the list icon next to the database field, depressing the right mouse button, and selecting the correct account from the popup list.

d. Enter the appropriate orid. The orid can be obtained by selecting the event in ARS and using the **<Control>a** keystroke combination to send the event to the **AlphaList**.

e. Toggle the desired processes/operations to **YES** by placing the cursor on the list icon next to the desired process, depressing the right mouse button, and selecting **YES** from the option list.

f. Select the **Execute** button to initiate execution for the selected processes.

g. When ProcessOrid has completed:

(1) Select the event in ARS.

(2) Use **ZAS** to examine the short-period origin beams for missed detections, or select **View⇒Later Phases⇒LP Phases** to search for long period detections.

(3) The event will need to be unfrozen (select the event and use the **Event Refinement⇒Origin⇒Unfreeze Origins** menu item) before any new detections can be added/associated to the origin.

- - NOTE - -

Note also that the current time block must be reread in order to update ARS's internal memory to be consistent with any alphanumeric or parametric information that ProcessOrid wrote to the database.

h. ProcessOrid provides several options that will likely never be used during routine analysis.

3-433. LOG OFF PROCEDURES.

3-434. Processes started from the analyst dman will be killed at end of session unless they are stopped by the analyst. This can result in loss of data. Therefore always follow the procedure steps below when exiting an analyst session.

a. Exit each application (e.g., ARS, XfkDisplay, Map, Discrim) using the **File⇒Exit** menu option through its main window.

(1) Never kill a process using the **<Control>c** keystroke combination.

(2) There will likely be a delay before the processes actually disappear from the display, because each process conducts some clean-up before exiting.

b. Check dman to verify all processes have been killed.

c. If some processes have not been killed (excluding dman), perform the following:

(1) Select the processes using the select mouse button.

(2) Select **Kill** from the dman toolbar (located in dman's middle section).

(3) Select **OK** from the (process termination) confirmation popup.

d. Exit dman using the **Programs⇒Exit** menu option, then select **OK** from the confirmation popup.

e. Select **Exit Session** from the CDE toolbar to exit the login session.

CHAPTER 4

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. Chapter 4 provides a system overview and a functional description of the United States National Data Center (US NDC). A thorough understanding of the function of the hardware components, the software, and the data flow between system components is critical to performing system administration and maintenance. This chapter is divided into five sections as follows:

a. Section I presents a system overview.

b. Section II provides a functional description of the hardware.

c. Section III provides descriptions of the data flow and processes in the Unclassified System.

d. Section IV provides descriptions of the data flow and processes for the Classified System data acquisition and archive functions.

e. Section V provides descriptions of the pipeline processes.

SECTION I

SYSTEM OVERVIEW

4-3. GENERAL.

4-4. The US NDC collects and analyzes geophysical data to monitor international compliance with the Comprehensive Test Ban Treaty (CTBT). The US NDC serves as a gateway between the US and the International Data Centre (IDC) for the exchange of geophysical data. Established at the Air Force Technical Applications Center (AFTAC) in Florida, the US NDC's primary function is to support the US monitoring and verification capabilities. The system supports:

a. Acquisition of seismic and hydroacoustic data.

b. Advanced seismic and hydroacoustic data processing.

c. Advanced seismic analysis techniques.

d. Forwarding of seismic and hydroacoustic data to the IDC and other users.

e. Staged archival of data including permanent storage.

4-5. The US NDC provides the capability to manage raw waveform data allowing the data to be analyzed using well-defined geophysical algorithms. These algorithms accomplish the detection and identification of man-made seismic events (i.e., nuclear detonations) among the thousands of natural and non-nuclear artificial seismic events observed yearly.

4-6. A top-level view of the system is shown in figure 4-1. The diagram shows the relationship between US NDC, its data sources, and its data recipients. The US NDC consists of an Unclassified System and a Classified System. The Unclassified System consists of the Unclassified Archive Subsystem and the Data Acquisition Subsystem. The Classified System consists of the Analysis Subsystem, the Classified Archive Subsystem, and the Analyst/Evaluator Subsystem. All internal and external communications are handled by the Unclassified and Classified Network Subsystems (not shown).

4-7. The US NDC is the repository of a large amount of data. The system is supported by a hierarchy of high volume, non-volatile storage devices for the raw waveforms. Access to the waveforms and other generated data is supported by a Relational Database Management System (RDBMS).

4-8. UNCLASSIFIED SYSTEM.

4-9. The Unclassified System supports the acquisition and archival of digital seismic data from unclassified sources. After acquisition and before archiving, data is forwarded to the Classified System for processing and archiving of the processed data. The Unclassified System also supports the transmittal of unclassified data received from the AFTAC networks to the IDC as well as other customers. The Unclassified Archive Subsystem retains received data for 180 days, at which time the waveform data is recorded on tape and archived.

4-10. The Unclassified System receives input from multiple data sources. See figure 4-1. The AFTAC Distributed Subsurface Network (ADSN) maintains the direct connections to the US Atomic Energy Detection System (USAEDS) field sites and exercises remote control over those sites where applicable.

4-11. Data arrives in one of two forms: alpha format and non-alpha format. Alpha format data takes one data path, whereas non-alpha data takes another path. The data paths are shown in figure 4-2. Network connections are not shown, since all entities in the diagram are on the same network.

4-12. The Diskloop Server performs all unclassified data acquisition functions including reformatting non-alpha data. The diskloop server contains the diskloops which are an efficient method of receiving data which arrives in non-uniformly-sized packets at irregular times. When data is received and complete (or is known to be incomplete for a time period),

it is sent to the external recipients via remote socket connections and forwarded to the Classified System. The Unclassified Archive Server (uarch) performs the unclassified waveform and database archive functions.

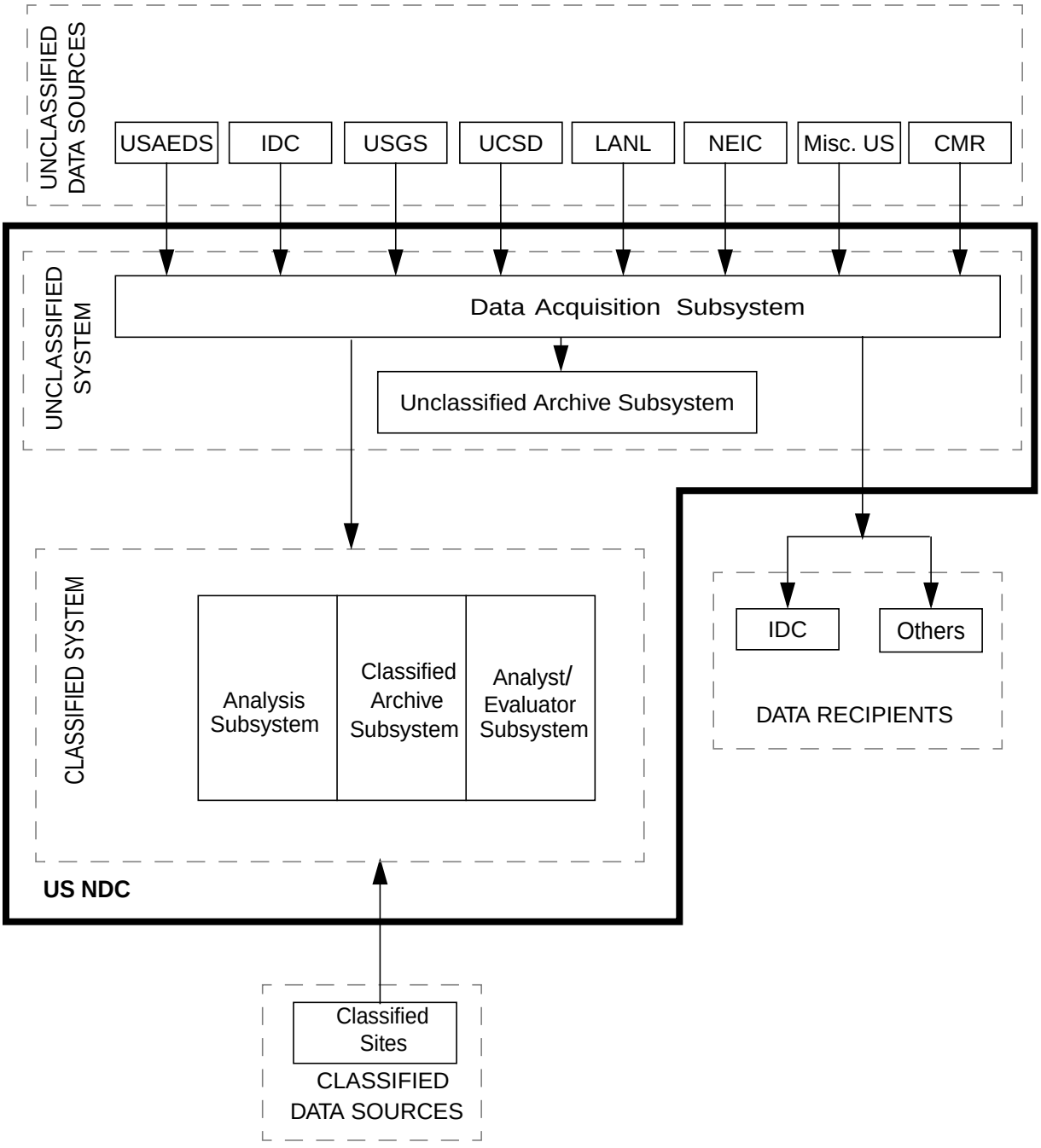

Figure 4-1. US NDC System Overview

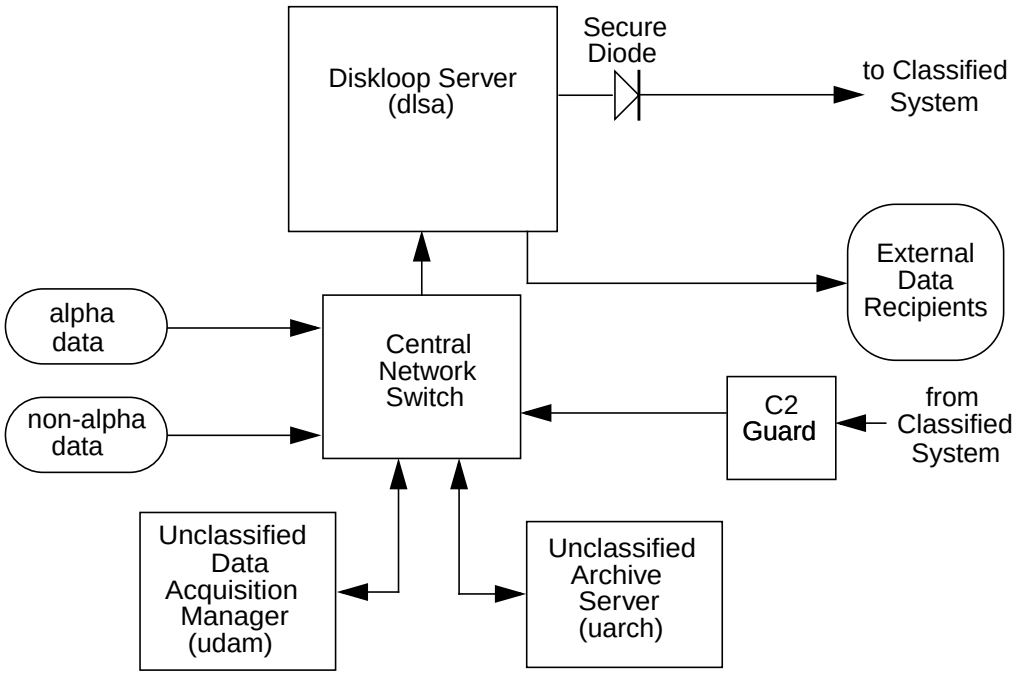

Figure 4-2. Unclassified System

4-13. Data transfer from the Unclassified System to the Classified System is accomplished by a Secure Diode link. The Secure Diode link provides a one-way secure data path from the Unclassified System to the Classified System.

4-14. The Unclassified Data Acquisition Manager (DAM) Station (udam) provides the capability to monitor and control the status of the real-time acquisition and archiving of waveform data.

4-15. CLASSIFIED SYSTEM.

4-16. The Classified System supports the following functions:

a. Data acquisition from the Unclassified System.

b. Data acquisition from classified sources.

c. Operation of the processing pipelines: Look-Forward, Global, Hydroacoustic, Broad Area Regional Monitoring (BARM), and Spotlight.

d. Seismic analysis.

e. Evaluation analysis.

f. Bulletin and report production.

g. Performance monitoring.

h. Data management.

i. Data archiving.

4-17. The Classified System operates on a local area network (LAN) isolated from the Unclassified System network except for communication paths provided by the Secure Diode link (refer to paragraph 4-13) and the Command and Control (C2) Guard, which enables secure file transfer to the Unclassified Network.

4-18. The Classified System hardware, exclusive of the network hardware, is functionally divided into the Analysis Subsystem, Classified Archive Subsystem, and the Analyst/ Evaluator Subsystem. A simplified block diagram of the Classified System hardware is shown in figure 4-3. The figure shows the association of the data processing elements with the other components of the system. Figure 4-3 omits most of the network-related hardware, including the hubs for various subnetworks, the console switches, and the hardware associated with the unclassified and classified C2 Guard interface. The following paragraphs provide brief descriptions of the primary hardware elements. A more detailed description of the hardware with all connections is given in section II of this chapter.

4-19. The Waveform Server (wfsa) receives data input and stores the data for immediate access by the Pipeline Processors and Analyst/Evaluator Stations. See figure 4-3.

4-20. The Pipeline Processors provide distributed processing for signal detection, feature extraction, automatic event building, and preparation of data for analyst use. Pipeline processed data is stored in the Pipeline Database Server (cdbsa).

4-21. The Classified Archive/DB Server (carch) manages the staged archiving of data obtained from the Pipeline Processors. See figure 4-3.

4-22. The Analyst and Evaluator Stations are divided into two groups of six machines each residing on separate subnetworks. The Analyst Stations provide the operator with the interface required to perform seismic event analysis, and the Evaluator Stations host the interface for event evaluation analysis.

4-23. The Classified Data Acquisition Manager (DAM) Station (cdam) provides monitoring and control of the data received from the Unclassified System to the Classified System to ensure the continuous acquisition and processing of the data.

4-24. The System Operations Manager (SOM) Station (som1) controls the Classified System operations associated with processing and preservation of data associated with the pipeline processing.

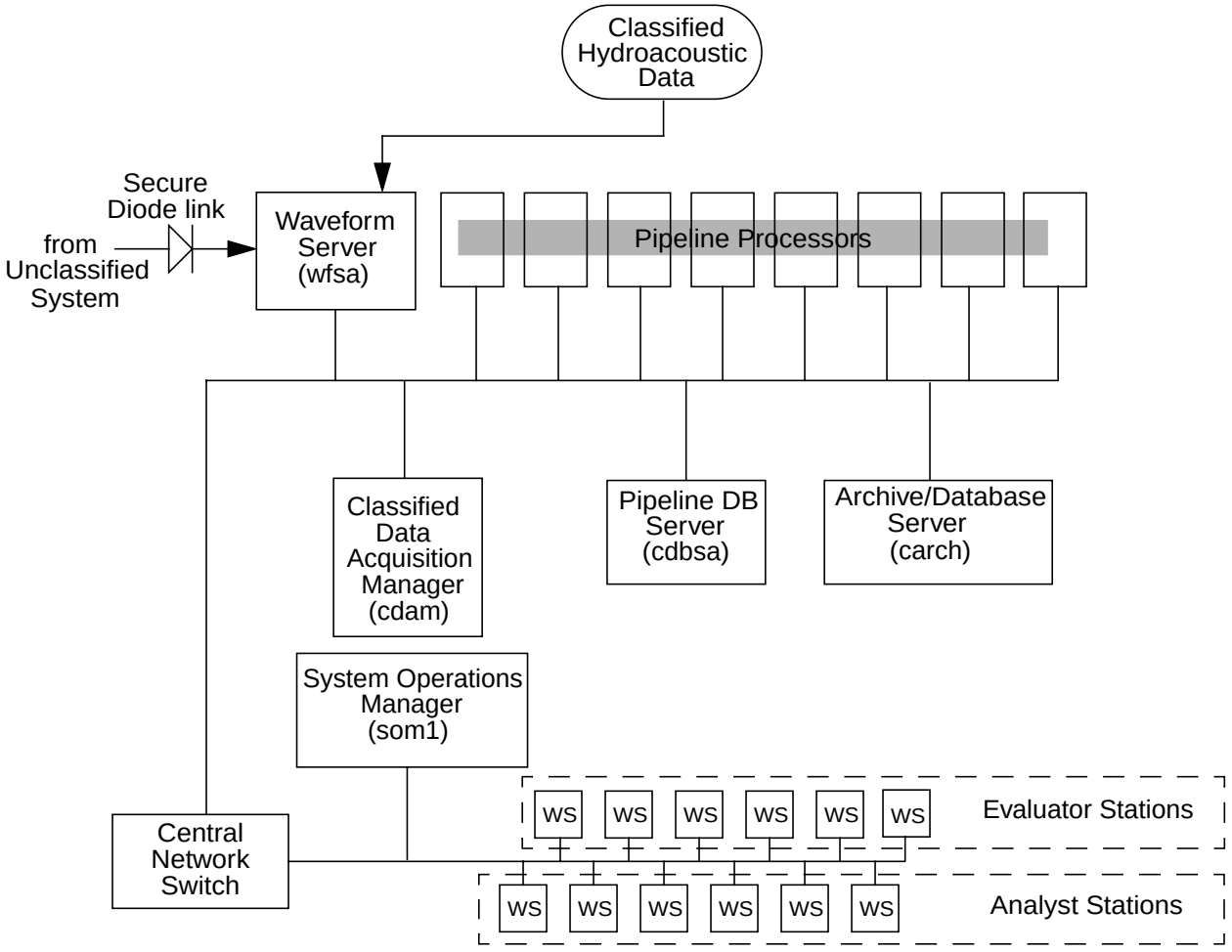

Figure 4-3. Classified System

4-25. PIPELINE PROCESSING.

4-26. Raw waveform data is processed to extract signal information. A number of different goals for processing are established. These goals each lead to processing schemes called pipelines. A pipeline is a sequence of processes for a defined input data set. Human analyst intervention occurs at three stages in the processing, which dictates the form of additional automatic processing stages. The pipelines and processing goals, including the type of coverage are listed in table 4-1.

4-27. Each pipeline performs a specific set of processes directed to the goal of the pipeline. Scheduling of the processing, in most cases, is initiated based on the availability of data. Completeness is important, but the system waits only a limited time for missing data. Data which arrives too late for a processing stage is subjected to preliminary processing and inserted into a later processing stage as feasible. Of the pipelines listed in table 4-1, the Global Teleseismic Pipeline is the most complex and extensive.

Table 4-1. Pipelines

PIPELINE	GOAL	COVERAGE
Global Teleseismic	Global	Worldwide
BARM	Regional	Broad Regional Area
Spotlight	Local, Regional	Selected local areas, small events
Hydroacoustic	Oceanic	Large marine events
Look-Forward	Special Interest	Targeted areas

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SECTION II

FUNCTIONAL DESCRIPTION

4-28. GENERAL.

4-29. As described in chapter 1 and shown in figure 4-4, the US NDC is functionally divided into two major systems and a number of subsystems. Section II provides a functional description of the hardware components within each subsystem. Detailed descriptions of the application software and process data flow as related to the overall system are contained in sections III, IV, and V of this chapter.

4-30. The Network Subsystems form the backbone for all communications and data transfer among the other subsystems. The relationships of the subsystems is depicted in figure 4-4 and outlined in the following paragraphs:

a. The Data Acquisition Subsystem performs the function of acquiring data from remote sites and the IDC and forwards data to the IDC, other organizations, and the Classified System.

b. The Unclassified Archive Subsystem stores all raw data acquired by the Data Acquisition Subsystem as well as IDC bulletin data for 180 days, and makes such data available to researchers.

c. The Analysis Subsystem accepts raw data from the Data Acquisition Subsystem and from classified hydroacoustic stations, and automatically performs a variety of seismic and hydroacoustic procedures on the raw data.

d. The Analyst/Evaluator Subsystem allows seismic analysts and evaluators to further refine the results of the automated processing and produce additional results and bulletins.

e. The Classified Archive Subsystem saves the results of both the automated and interactive analysis, as well as the raw data.

f. All subsystems are physically interconnected through a combination of high-capacity, fast ethernet LAN switches.

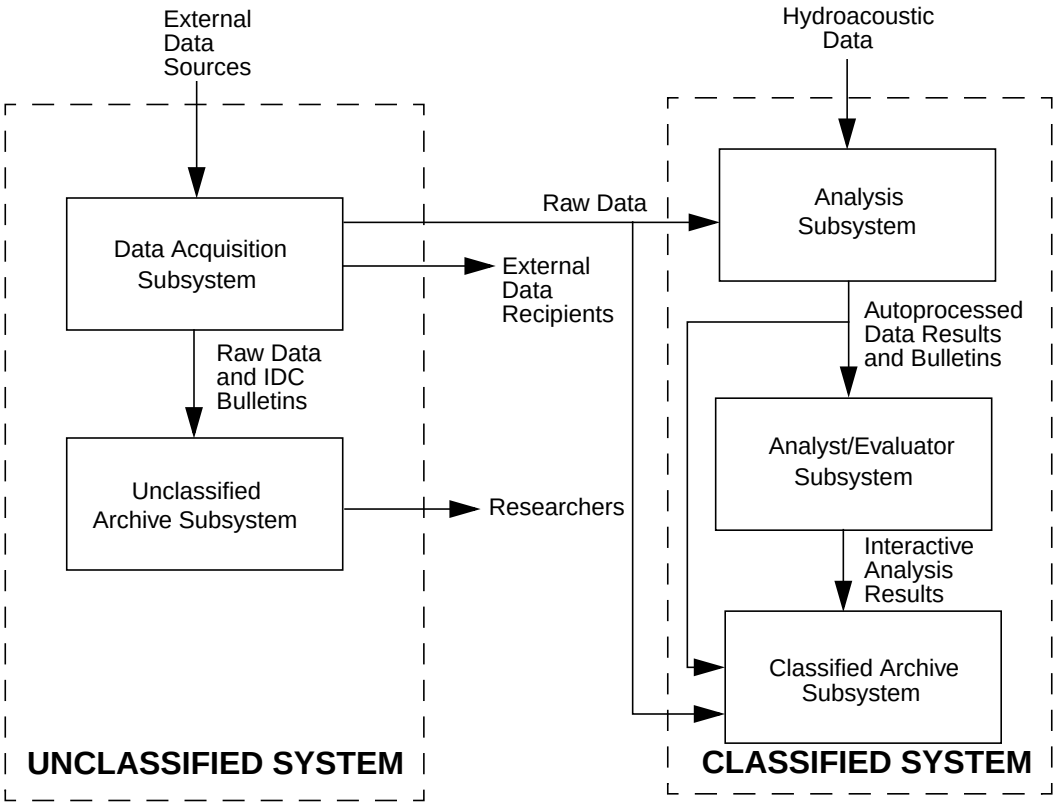

Figure 4-4. Subsystem Interrelationships

4-31. UNCLASSIFIED AND CLASSIFIED NETWORK SUBSYSTEMS.

4-32. The Unclassified and Classified Network Subsystems provide all data communications between the other subsystems and all data communications interfaces between the US NDC and external systems and networks. See figure 4-5. They also incorporate the station positions used for performing overall system, network, and database administration functions for the US NDC. Finally, the Network Subsystems incorporate the interfaces between the Unclassified and Classified Systems. All data communications over the network use Transmission Control Protocol/Internet Protocol (TCP/IP). All other communications protocols used, such as the alpha protocol, are layered on top of TCP/IP.

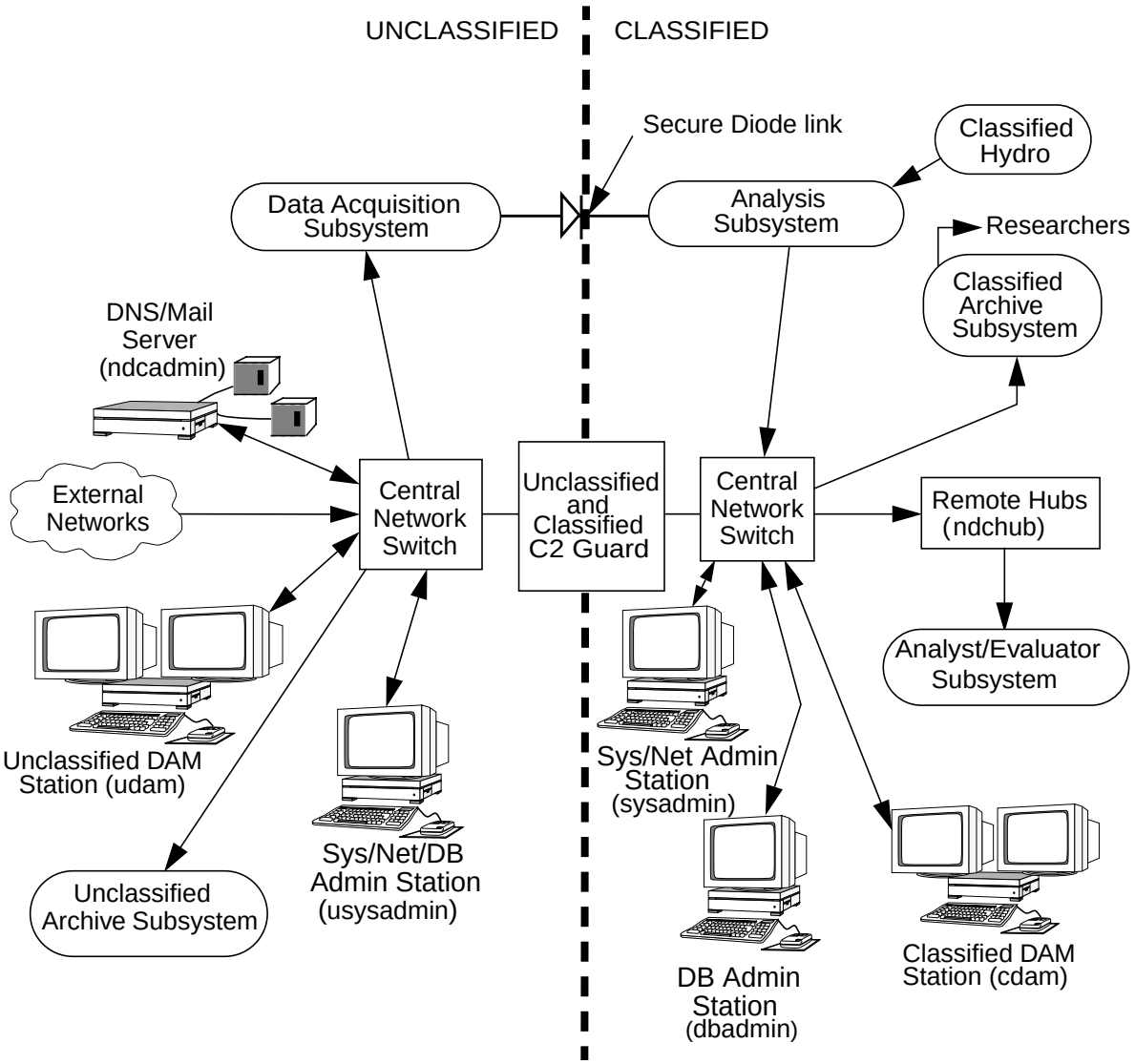

Figure 4-5. Unclassified and Classified Network Subsystems

4-33. UNCLASSIFIED AND CLASSIFIED CENTRAL NETWORK SWITCHES.

4-34. Inter-subsystem communications are provided by the combination of the Central Network Switches, Remote Hubs, and ethernet connections. The Unclassified and Classified Central Network switches interconnect all the US NDC equipment and have the capability to segregate groups of ports into virtual local area networks (VLANs). When VLANs are established, the switch prevents direct transmission of ethernet packets from any port of one VLAN to any port of another VLAN. Each VLAN functions as a physically isolated

ethernet segment. Any flow of information from one VLAN to another must be accomplished by an external routing device.

4-35. The data communications interface to unclassified external systems is provided by a combination of an external router and the AFTAC firewall. The external router provides data circuit links to all the external networks from which the US NDC either receives raw data or forwards raw data. The external router is connected to the AFTAC network firewall. This provides a security barrier between the US NDC and any potentially hostile force trying to gain access by way of the external data circuits.

4-36. REMOTE HUBS.

4-37. The remote hubs connect the Analyst/Evaluator Stations to the Central Network Switch on the Classified System.

4-38. SYS/NET/DB ADMIN AND DB ADMIN STATIONS (usysadmin, sysadmin, dbadmin).

4-39. The Sys/Net/DB Admin Station (usysadmin) provides the resources to perform the system, network, and database administration duties on the Unclassified System. The Classified System uses two stations to perform the administration duties: a Sys/Net Admin Station (sysadmin) and a DB Admin Station (dbadmin).

4-40. DNS/MAIL SERVER (ndcadmin).

4-41. The DNS/Mail Server (ndcadmin) provides domain look-up service and IP address definition on input and queries from data sites and also performs mail forwarding services. Additionally, it holds the user account home directories and is the master Network Information Services (NIS) Server for the Unclassified System.

4-42. SECURE DIODE LINK.

4-43. The Secure Diode link provides continuous one-way transmission of information from the Unclassified System to the Classified System. It uses an optical fiber link in which the transmit port on the unclassified side is connected to the receive port on the classified side, but no connection is made in the reverse direction. Consequently, it is physically impossible to transmit data from classified to unclassified.

4-44. C2 GUARD.

4-45. The C2 Guard consists of three computers: Unclassified Interface (lqmgr), Classified Interface (hqmgr), and XTS300 Controller. The C2 Guard is an accredited secure file transfer system for bi-directional transmission of files between the Classified Network Subsystem and the Unclassified Network Subsystem. It uses restricted file formats and content analysis techniques, such as keyword filtering, to ensure that classified information is not transmitted to the unclassified segment.

4-46. UNCLASSIFIED AND CLASSIFIED DATA ACQUISITION MANAGER STATIONS (udam, cdam).

4-47. The DAM stations (udam on the unclassified side and cdam on the classified side) provide the capability to monitor and control the status of the real-time acquisition and archiving of waveform data from the ADSN USAEDS stations, ASN stations, and the IDC. The operation of udam and cdam is identical. Using the WorkFlow graphical user interface (GUI), the DAM operator can verify normal operations as well as detect reduced capabilities due to abnormal conditions, such as interruptions in external communications. By using the Launch GUI, the DAM operator can selectively start and stop individual data acquisition processes on specific processors, therefore effecting total control over receiving, forwarding, and archiving functions.

4-48. DATA ACQUISITION SUBSYSTEM.

4-49. The Data Acquisition Subsystem acquires data and forwards data to the external data recipients and to the Classified System. See figure 4-6. The Data Acquisition Subsystem consists of the Diskloop Server (dlsa) and one Console Switch.

4-50. DISKLOOP SERVER (dlsa).

4-51. The function of the Diskloop Server (dlsa) is the acquisition, conversion, and forwarding of seismic and hydroacoustic waveforms accepted from authorized unclassified sites. This capability is described in paragraph 4-112 which also describes data forwarding to the Classified System.

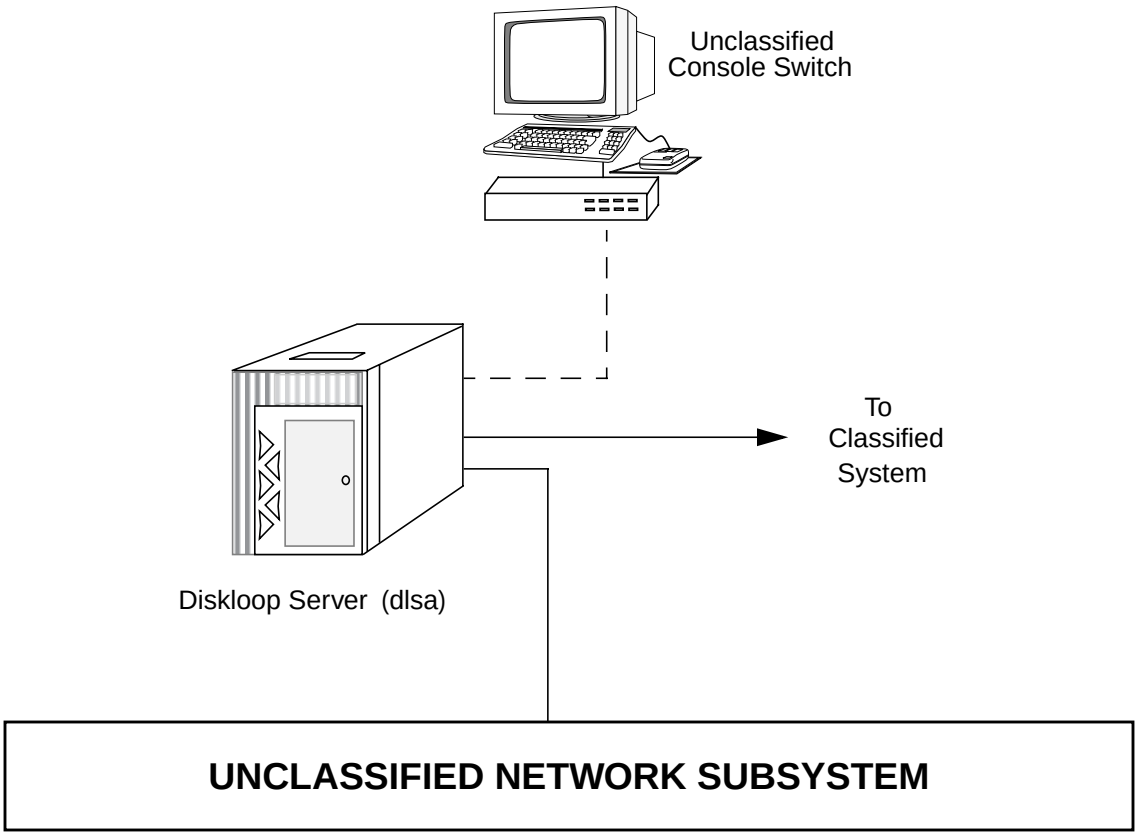

Figure 4-6. Data Acquisition Subsystem

4-52. UNCLASSIFIED CONSOLE SWITCH.

4-53. The Console Switch provides the means to allow a single monitor and keyboard to be connected to multiple processors on the same system. Selection of the active port can be changed at any time by a keyboard command. Operation of the console port does not interrupt proper functioning of the associated processor.

4-54. UNCLASSIFIED ARCHIVE SUBSYSTEM.

4-55. The Unclassified Archive Subsystem (figure 4-7) provides long-term and permanent storage of data received by the Data Acquisition Subsystem. The Unclassified Archive Subsystem consists of the Unclassified Archive/Database Server (uarch) and a DLT tape library.

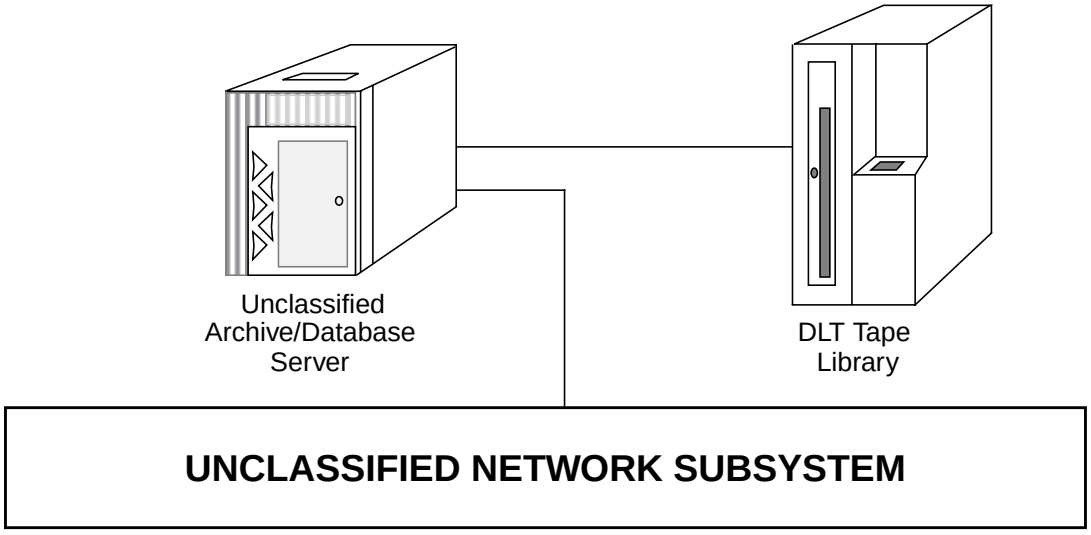

Figure 4-7. Unclassified Archive Subsystem

4-56. UNCLASSIFIED ARCHIVE/DATABASE SERVER (uarch).

4-57. Raw waveforms are stored in the file system of this machine for a period of five days. After five days, waveforms are transferred to the digital linear tape (DLT) robot storage for 180 days.

4-58. The Unclassified Archive/DB Server (uarch) holds a single database instance (ie., uarch) identified as uarch which stores the waveform descriptor records (wfdisc) for all waveforms stored in the unclassified archive and the IDC bulletins.

4-59. ANALYSIS SUBSYSTEM.

4-60. The Analysis Subsystem (figure 4-8) hosts the classified data acquisition and automatic processing functions. The Analysis Subsystem consists of one Waveform Server (wfsa), one Pipeline DB Server (cdbsa), eight Pipeline Processors (pipe1a - pipe8a), and one Classified Console Switch.

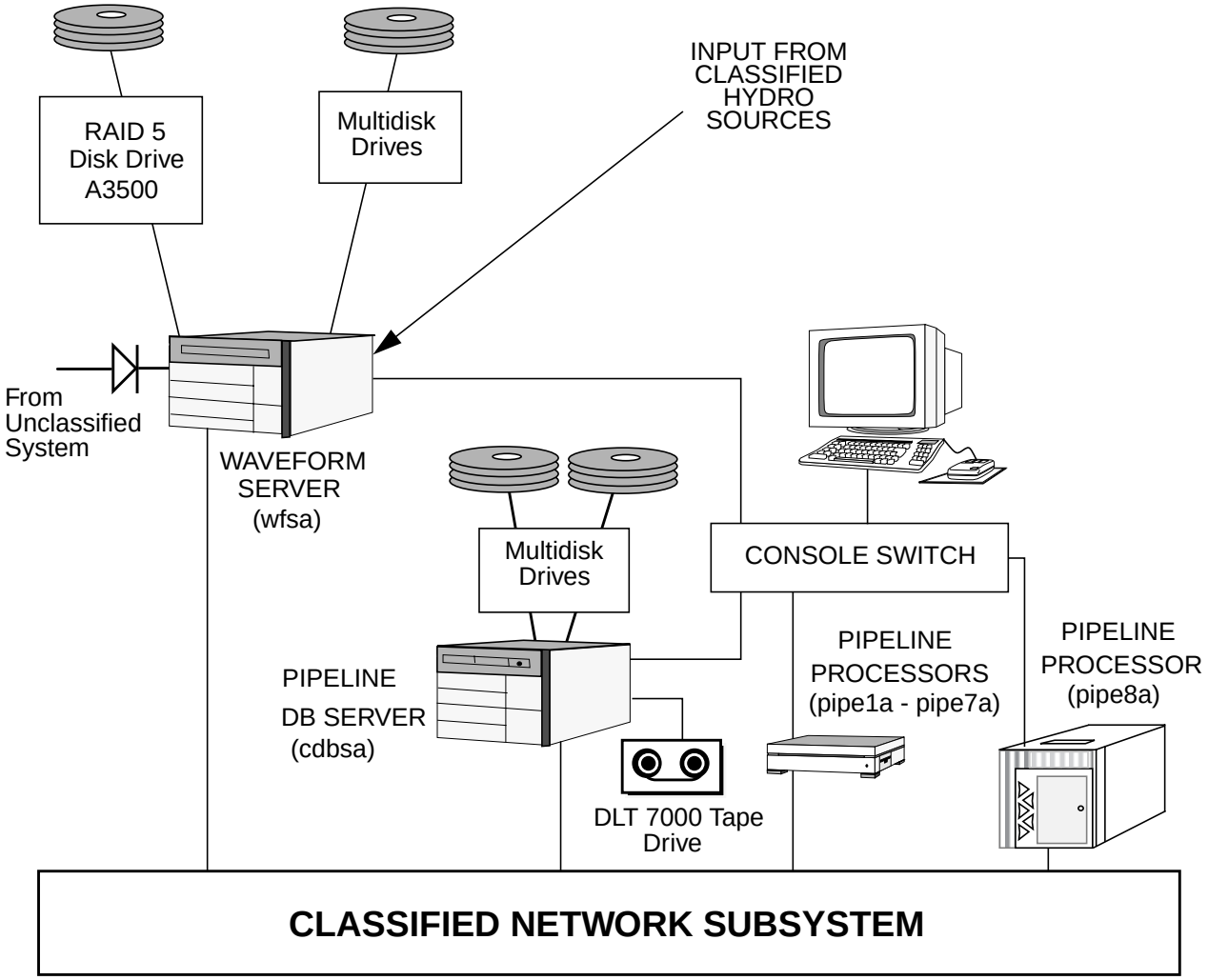

Figure 4-8. Analysis Subsystem

4-61. WAVEFORM SERVER (wfsa).

4-62. The Waveform Server (wfsa) has the connection to the receiving side of the secure diode. It performs acquisition of interval data from the Unclassified System, and acquisition and storage of waveform data from the Unclassified System as well as from the Classified Hydro sites.

4-63. In addition to its data acquisition function, wfsa includes a disk array storage capacity of 2184 GBbytes and serves as the source for all waveforms selected for analysis and evaluation at the Analyst/Evaluator Stations. It provides storage for 45 days of raw and derived waveforms and serves as the source for the classified archiving process.

Additionally, it holds the user account home directories and is the master NIS Server for the Classified System.

4-64. PIPELINE DATABASE SERVER (cdbsa).

4-65. The Pipeline DB Server (cdbsa) is the repository of the wfdisc table which catalogs all waveforms, regardless of type, that have been received and are resident on the waveform server. In addition, it is the repository and temporary storage area for all final and intermediate alphanumeric data generated by the analysis and evaluation activities.

4-66. The Pipeline DB Server (cdbsa) hosts the instance of a database which contains the diskloop waveform catalog (wfdisc table) and all the derived analysis products (commonly referred to as alphanumeric data). A DLT tape drive provides data backups and restoration capability.

4-67. PIPELINE PROCESSORS (pipe1a - pipe8a).

4-68. The eight Pipeline Processors (pipe1a - pipe8a) provide the capability for analysts and evaluators to run the geophysical algorithms on waveform data stored on the Waveform Server (wfsa). These algorithms are exercised either under program control or by selection at the Analyst/Evaluator Station.

4-69. CLASSIFIED CONSOLE SWITCH.

4-70. Each processor in the Analysis Subsystem is connected to a Classified Console Switch and console monitor in the same manner as described for the Unclassified Data Acquisition Subsystem.

4-71. CLASSIFIED ARCHIVE SUBSYSTEM.

4-72. The Classified Archive/Database Subsystem (figure 4-9) includes the Classified Archive/Database Server (carch).

4-73. CLASSIFIED ARCHIVE/DATABASE SERVER (carch).

4-74. The Classified Archive/Database Server (carch) is the classified data archive and associated database. Raw waveforms are stored in the file system of this machine for a period of approximately 30-45 days. At any given time, the archiving processes access the Waveform Server (wfsa). This function is described more completely in paragraph 4-159.

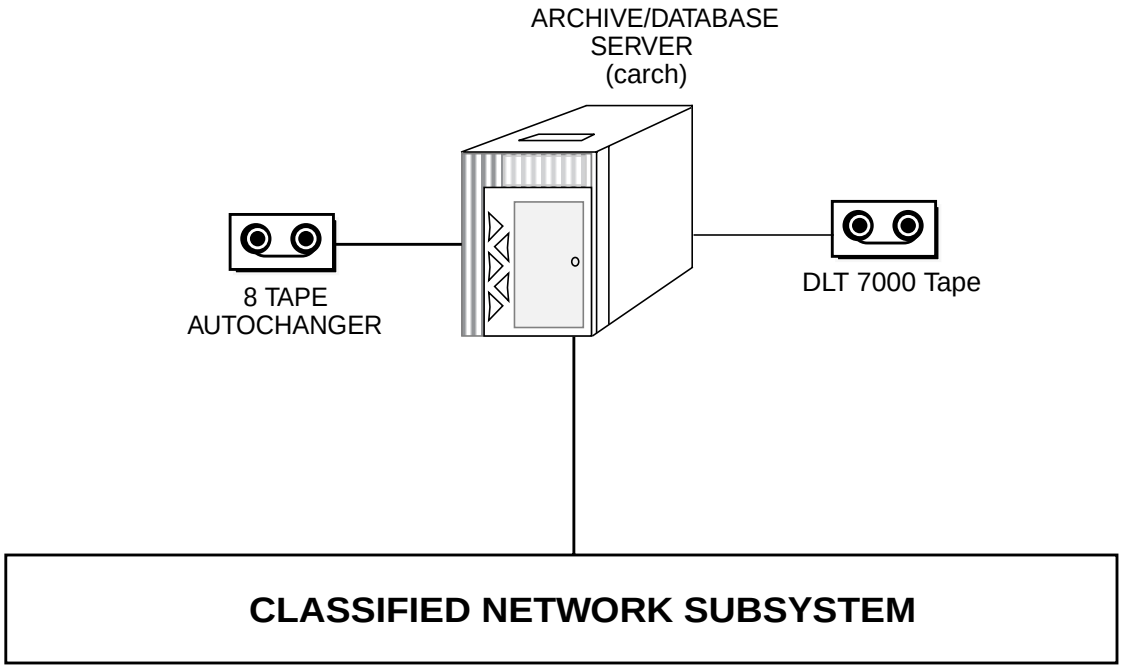

Figure 4-9. Classified Archive Subsystem

4-75. The Classified Archive/Database Server (carch) also hosts an Oracle database instance which holds the waveform descriptor records (wfdisc) for all waveforms stored in the classified archive. The classified archive database also holds copies of all the alphanumeric data produced by automated/interactive processing over the lifetime of the US NDC. As waveforms are migrated from short-term to permanent archive, a staging area temporarily stores the data. This area is also used to download waveform data from the DLT to the US NDC Classified System.

4-76. ANALYST/EVALUATOR SUBSYSTEM.

4-77. The Analyst/Evaluator Subsystem (figure 4-10) provides the interactive processing function. It consists of identically configured stations in dual monitor configuration with one station serving as the System Operations Manager (SOM).

4-78. ANALYST AND EVALUATOR STATIONS (analyst1 - analyst6 AND eval1-eval6).

4-79. The Analyst Stations (analyst1 - analyst6) and Evaluator Stations (eval1 - eval6) provide operational personnel with the ability to exercise and control the seismic processing of stored waveforms. The process is accomplished at the station.

4-80. SOM STATION (som1).

4-81. The SOM Station is provided for the implementation and exercise of seismic operations management activities on the Classified System.

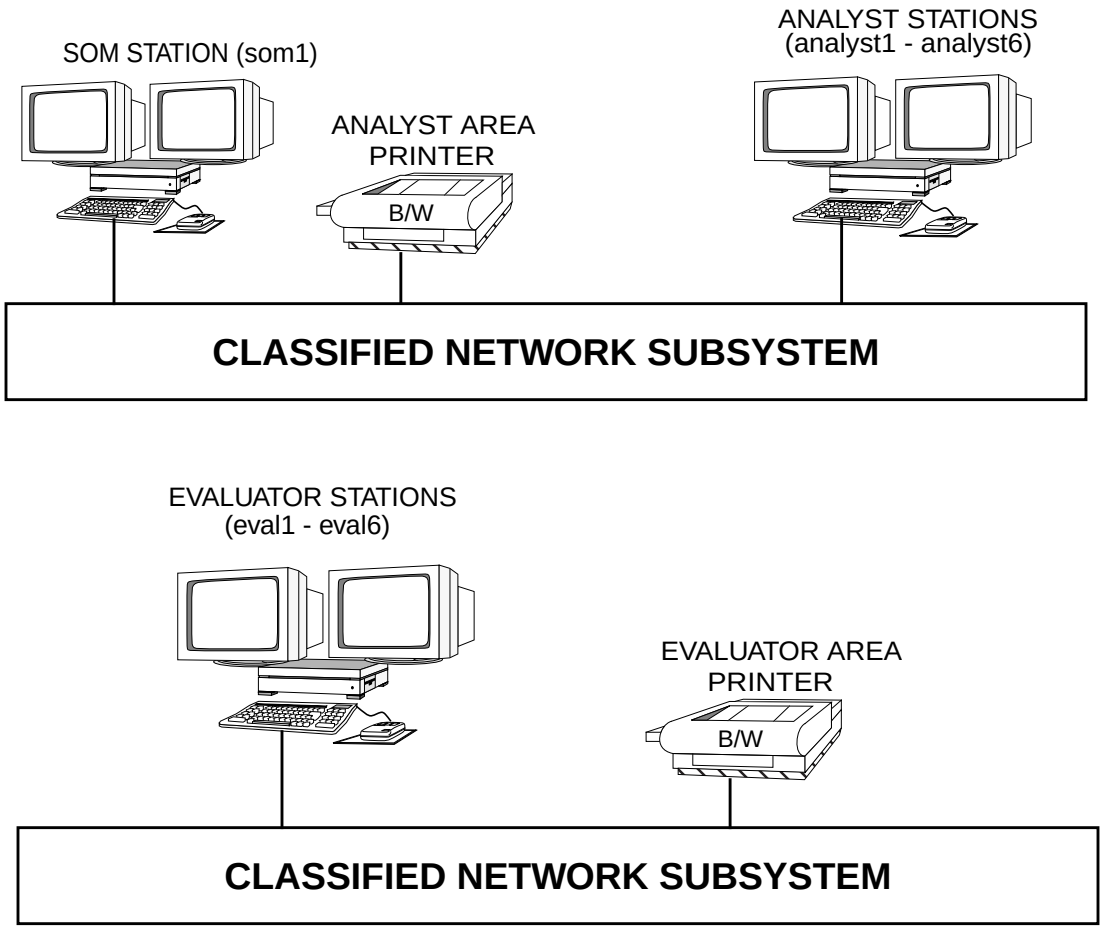

Figure 4-10. Analyst/Evaluator Subsystem

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SECTION III

UNCLASSIFIED SYSTEM PROCESSES AND DATA FLOW

4-82. GENERAL.

4-83. The Unclassified System performs the following three principal functions:

a. Data Acquisition

b. Data Forwarding

c. Data Archiving

4-84. DATA ACQUISITION.

4-85. The data acquisition function consists of external connection management, data conversion, interval processing and diskloop management subfunctions. The following paragraphs describe each of these subfunctions.

4-86. INTERNAL CONNECTION MANAGEMENT.

4-87. The unclassified gap handling component attempts to fill data gaps automatically. It obtains outage reports from the Unclassified C2 Guard, attempts to reconcile missing data, and puts missing data that has been found from the UDAS onto gap heap files for the Unclassified Data Forwarding component.

4-88. EXTERNAL CONNECTION MANAGEMENT.

4-89. The management of the connections to external data sources is a major subfunction. The Unclassified System uses a variety of connection management methods for external data sources. Connection management, as discussed in this section, is relevant only to sites supplying inbound data. Connections to the Unclassified System are discussed in the following paragraphs.

4-90. DATA SOURCES (INPUTS). The data coming into the US NDC appear in the four following data formats:

a. Alpha

b. Center for Seismic Studies (CSS)

c. Data Transaction Center (DTC)

d. SUDS

4-91. Conversion routines are necessary to modify the inputs to a common internal format. Once converted, the data, as well as the original data from the alpha sites, is processed by the assigned Diskloop Manager (DLMan) process.

4-92. CSS and DTC formats require conversion. The conversion programs are file2Alpha and dtc2alpha, respectively. There are one or more instances of each of these programs running on the Diskloop Server (dlsa). The failure of either of these programs will cause cessation of the CSS or DTC data streams, as applicable, to that processor.

4-93. DATA DESTINATIONS (OUTPUTS). Data received by the US NDC is subsequently forwarded to a number of authorized customers. Data is forwarded on a station-by-station basis to the IDC and the Center for Monitoring Research (CMR). Data is forwarded to the US NDC Sustainment System. This system is used for software development. The data is forwarded in alpha format. In addition to providing data to the external entities, data is transferred in alpha format to the Classified System through a Secure Diode link.

4-94. CONNECTIONS TO ALPHA SITES. Connections to alpha sites are all handled identically. The sockd program, running on Diskloop Server (dlsa), waits for connection requests from any external site across the network. Once a request is received, sockd spawns a copy of the ConnMan program to handle the request. ConnMan validates the request, rejecting any from unauthorized sites, and responds to the originating system. This response contains the IP address of the diskloop server and the port number of the DLMan program instance that will accept the data. Once completed, ConnMan terminates. This interaction is illustrated in figure 4-11. The numbers appended to the data flows indicate processing sequence.

4-95. CONNECTIONS TO ASN SITES (VIA ADSN). Connections to the ASN sites through the ADSN are made via the putfiled program which executes on the US NDC Diskloop Server (dlsa). The US NDC putfiled program waits for network transactions from the putfile program executing on the ADSN machine amazon. Upon receipt of a transaction from ADSN, the US NDC putfiled writes the transaction to a file on Diskloop Server (dlsa).

4-96. CONNECTIONS TO USAEDS SITES (VIA ADSN). Descriptions of the connections to the USAEDS stations (via ADSN) are provided in the following:

a. Realtime Data - The connections to the USAEDS stations are made through the ADSN machine dcol3. A program running on dcol3, called DFS, receives a connection from dtc2alpha programs running on the Diskloop Server (dlsa). Waveform data is sent in DTC format, converted to alpha, and put in heap files by dtc2alpha.

b. Gapped Data - Gaps in the USAEDS data are pulled into the NDC in CSS 3.0 format. The data is collected from dcol3 as well as directly from the field sites. After the data is gathered, the file2alpha process converts the data and puts it in heap files on the Diskloop Server (dlsa).

4-97. CONNECTION TO LANL. The connection to Los Alamos National Laboratory (LANL) is a variation of a push model. A processor at LANL Network File System (NFS) mounts a directory/file system on the US NDC machine Diskloop Server (dlsa) and writes (i.e., pushes) waveform data to it. As long as the network is up and Diskloop Server (dlsa) is running (functional), the passive connection to LANL is up.

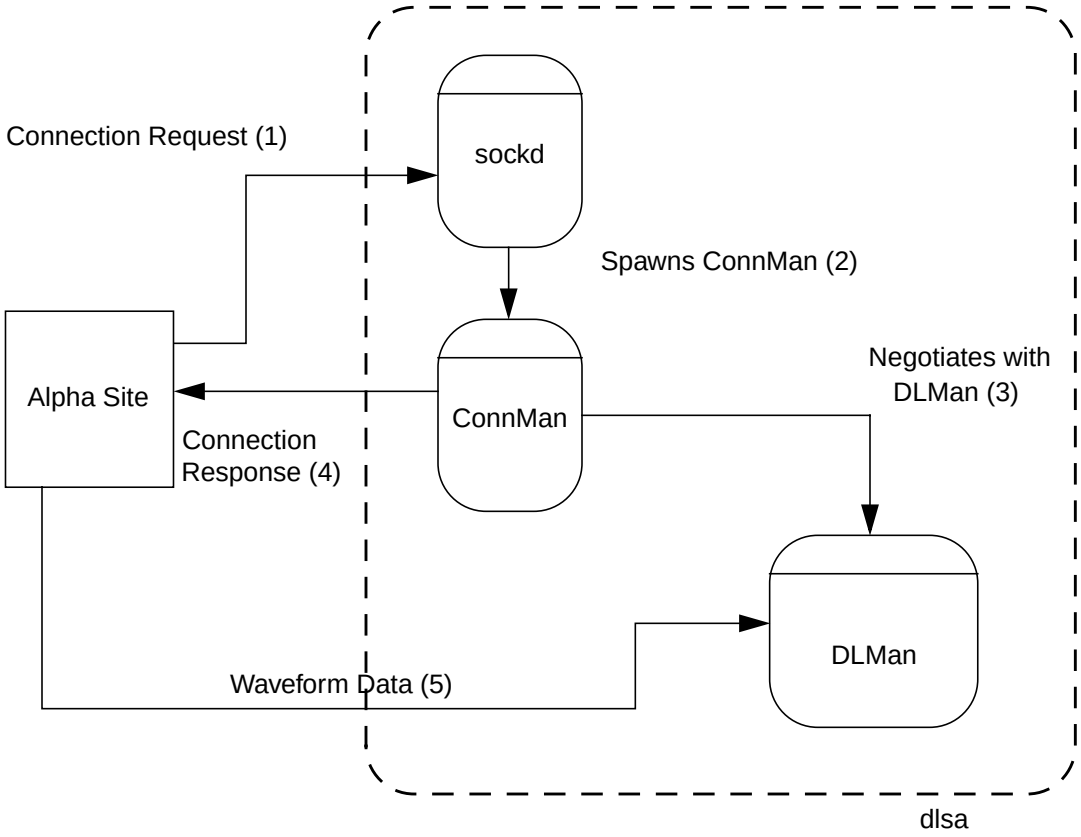

Figure 4-11. Alpha Site Connections to US NDC

4-98. DATA CONVERSION.

4-99. Data entering the Unclassified System arrives in one of the following four formats:

a. Alpha

b. SUDS

c. CSS

d. DTC

4-100. Data received in alpha-format does not require conversion; however, the data from ASN, USAEDS, and LANL is not in alpha-format and must undergo a conversion.

4-101. ASN SITES AND LANL. The ASN stations and LANL will be discussed together since their entrance to the US NDC is similar. Both interfaces are to the Diskloop Server (dlsa). See figure 4-12.

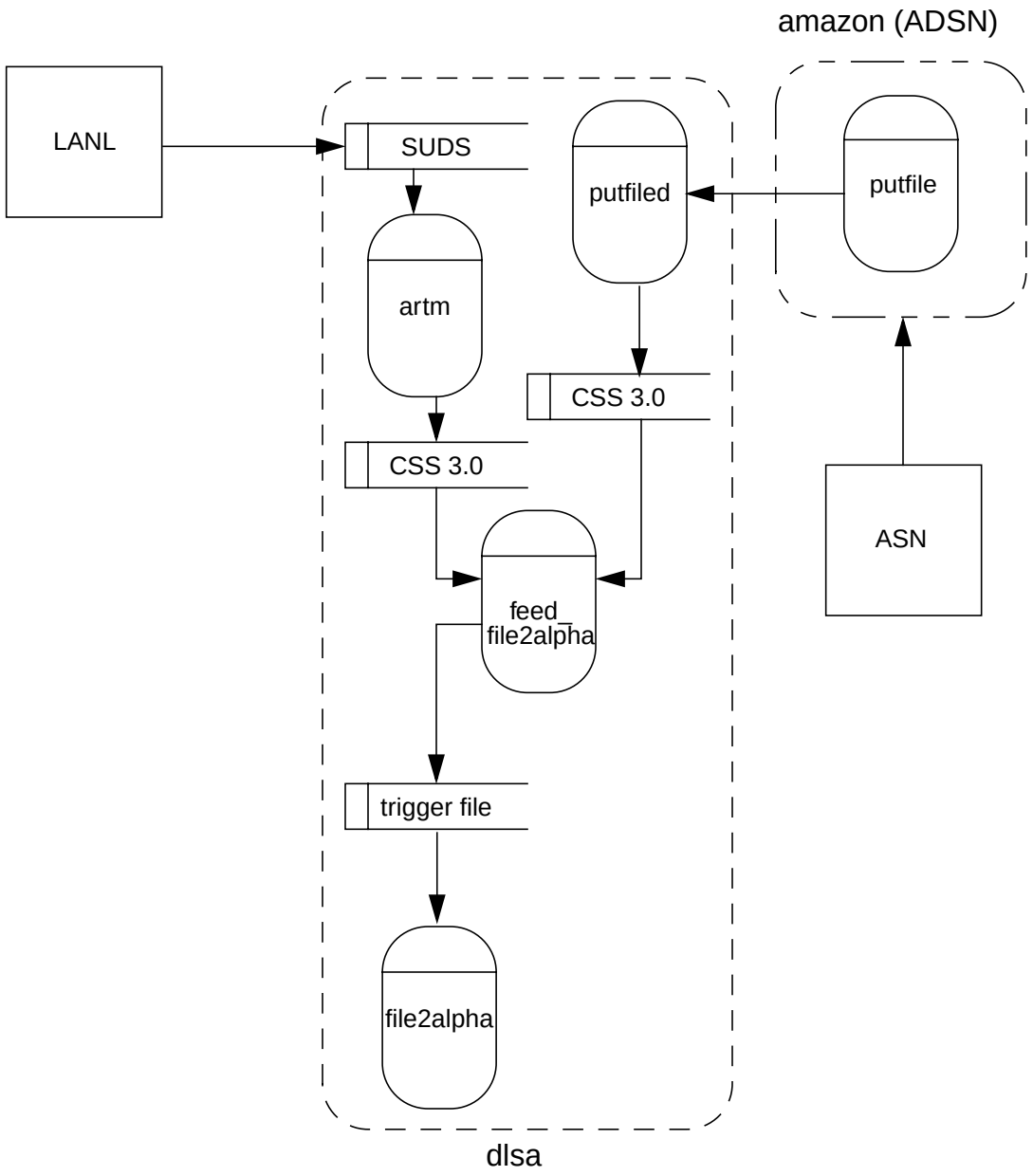

Figure 4-12. LANL and ASN Data Acquisition

4-102. The LANL NFS writes SUDS format waveform files to Diskloop Server (dlsa). The SUDS format files are processed by a program called artm, which converts the waveforms to CSS 3.0 format and places the output in local files for further processing.

4-103. The ASN data comes through the ADSN machine amazon. A process called putfile opens a socket connection to a US NDC process called putfiled running on Diskloop Server (dlsa). CSS-3.0 compliant files are sent to the US NDC and written to local files by putfiled.

4-104. Local CSS 3.0 files are subsequently processed by a program called feed_file2alpha running on Diskloop Server (dlsa). The output of this process is a trigger file, which is accessed by the file2alpha processes running on the Diskloop Server (dlsa). A trigger file contains a list of files to be processed. This process is illustrated in figure 4-12.

4-105. USAEDS SITES. Descriptions of the USAEDS sites are provided in the following:

a. Realtime Data - The USAEDS sites provide data in DTC format to the US NDC through the ADSN system. The DFS process accepts a TCP/IP socket connection and sends DTC-formatted transactions to the dtc2alpha process running on the diskloops of the Diskloop Server (dlsa). The dtc2alpha process converts the DTC-formatted data into alpha data and places it into heap files for subsequent processing by the AlphaForward process, which is responsible for inbound data interfaces.

b. Gapped Data - Gaps in the USAEDS data are filled by pulling CSS 3.0-formatted data from dcol3 and the field sites. This data is pulled to the US NDC using a process called LateData. The data collected by the LateData process is passed to file2alpha which converts the data into Alpha format and stores the data in heap files for access by AlphaForward.

4-106. INTERVAL PROCESSING.

4-107. In addition to the data interface to the Classified System described in paragraph 4-93, the Unclassified System forwards interval information to the Classified System for display in the classified Data Acquisition WorkFlow. Interval information is generated by processes running on the Diskloop Server (dlsa), then forwarded to the Classified System. Interval processing is illustrated in figure 4-13. Interval processing consists of four programs (update_interval, send_interval, file_send and diode_send) running on the Diskloop Server (dlsa).

4-108. The update_interval process generates interval information for the unclassified Data Acquisition WorkFlow. The send_interval process places the interval information in ASCII files every 60 seconds and makes them available to file_send for transfer to the Classified System. The file_send process looks every 60 seconds for files to send to diode_send for transmission across the diode to rt_reader (on Waveform Server (wfsa)) in the Classified System.

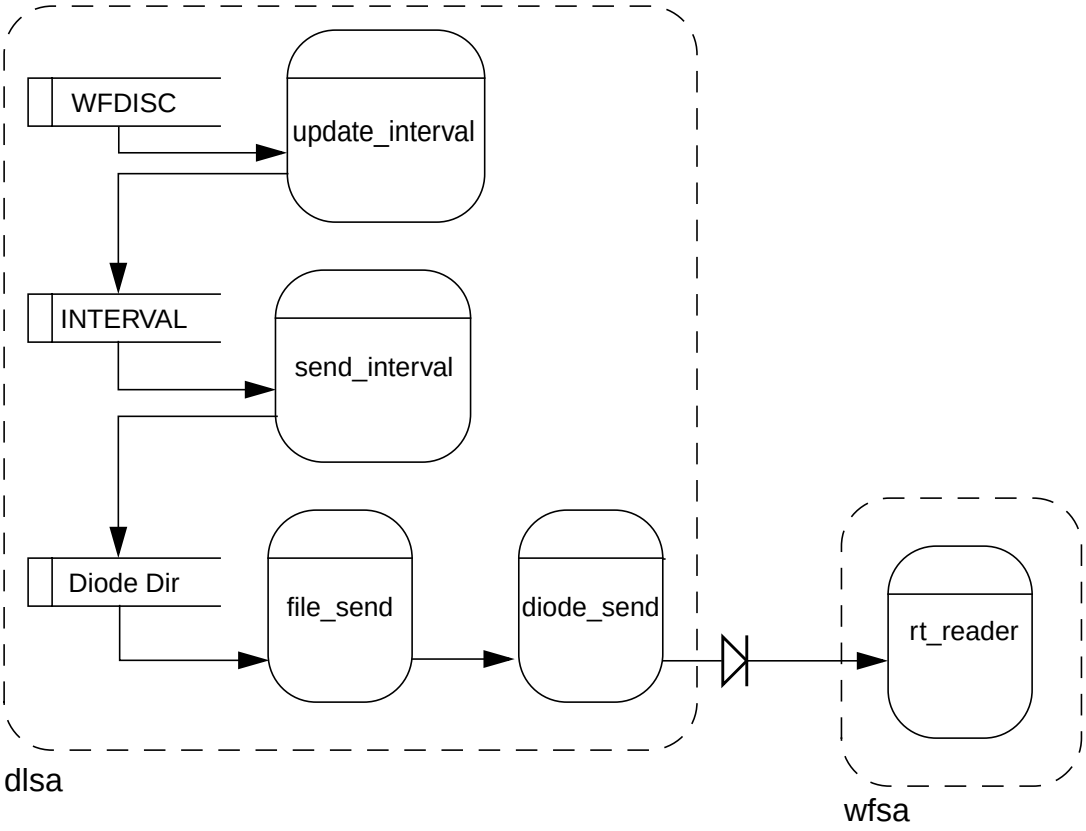

Figure 4-13. Interval Processing

4-109. DISKLOOP MANAGER.

4-110. DLMan has the principal function of accepting alpha waveform data from sites which have negotiated a connection through a US NDC ConnMan instance. DLMan is started by the operator at system start-up and runs indefinitely. There are three instances of the DLMan program running simultaneously on the Diskloop Server (dlsa). See figure 4-14.

4-111. Once started, DLMan reads its `.par` file which defines the ports on which to send and receive data. After the initialization sequence is complete, DLMan updates the DLMan table in the database to register its existence and waits for data packets pushed from alpha sites. When received, and having verified the data comes from a legitimate source by accessing the ALPHASITE table in the database, DLMan stores the waveforms in the appropriate diskloop file and updates the wfdisc table in the database.

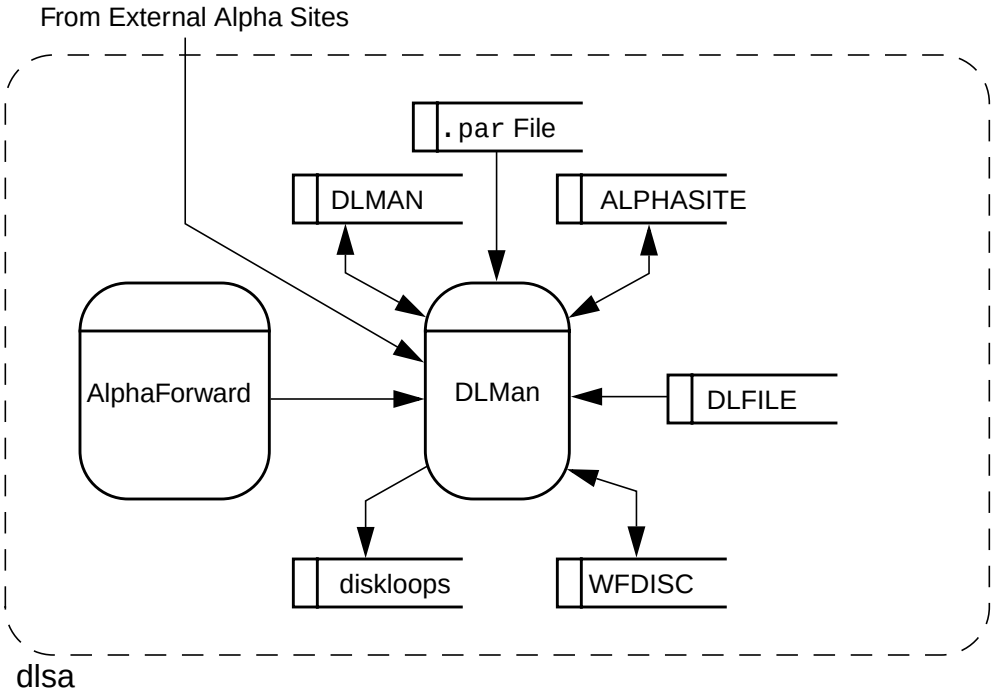

Figure 4-14. The DLMan Acquisition Program

4-112. DATA FORWARDING.

4-113. DESTINATIONS.

4-114. IDC AND CMR. The IDC and CMR serve as both a source and destination of seismic waveforms. The data interface is strictly compliant with the alpha protocol in both directions. Forwarding to the IDC from the AlphaForward process running on each of the Diskloop Server (dlsa) is shown in figure 4-15.

4-115. CLASSIFIED SYSTEM. The Classified System is the analytical and evaluation facility of the US NDC. Data received by the Unclassified System is forwarded, unmodified except for format, to the Classified System. The transfer is exclusively one-way.

4-116. ANCILLARY DATA CUSTOMERS. The US NDC has three external customers for data acquired by the Unclassified System: SMU, SNL, and IRIS. At AFTAC, there are three machines which function as the interface. Although US NDC-developed software is resident on these machines and supports the data transfer to the stated destinations, these machines and software are considered external to the US NDC.

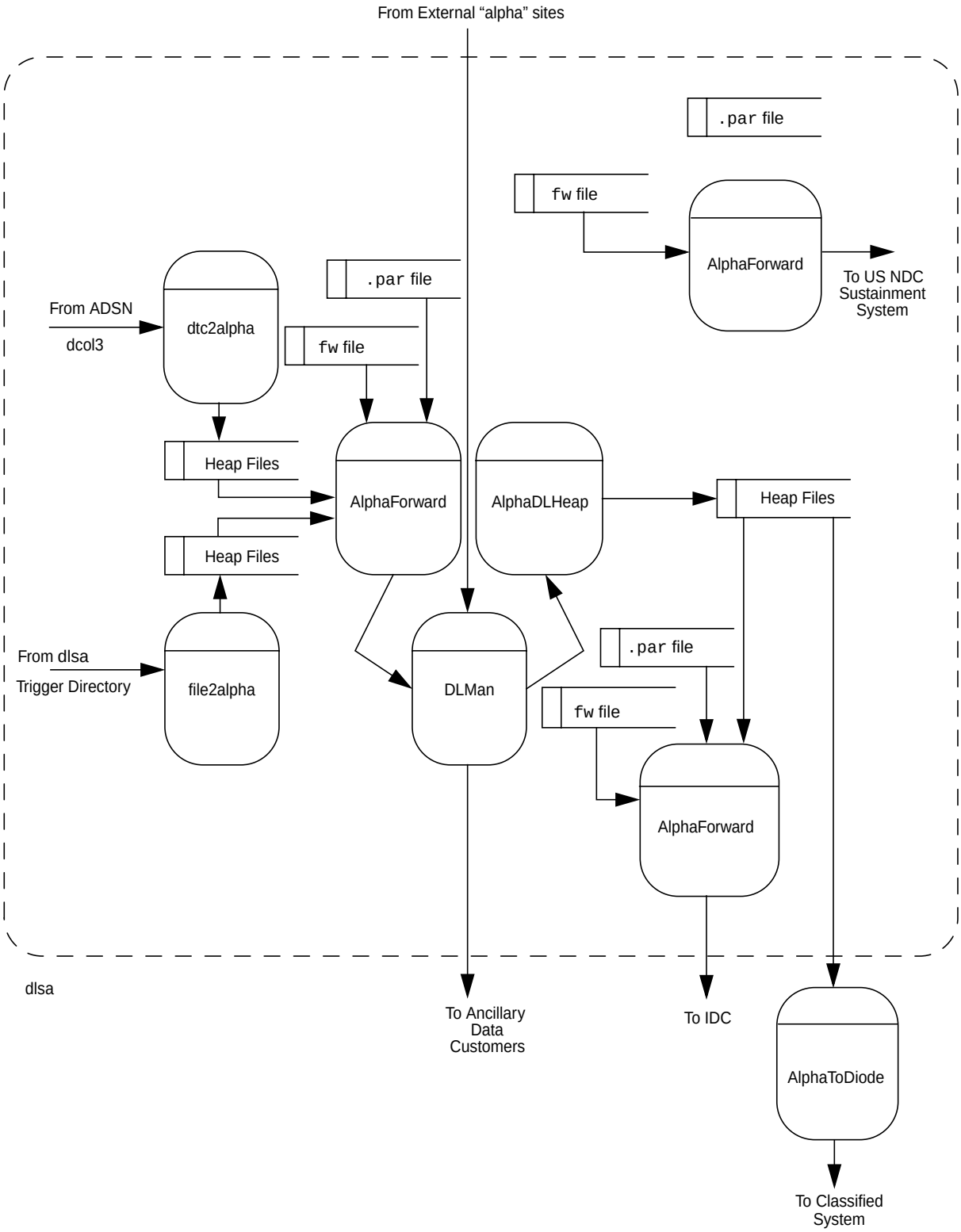

Figure 4-15. Data Forwarding

4-117. PROCESSES.

4-118. Data destined to be forwarded to the IDC and the Classified System is sent to a locally resident AlphaDLHeap program. If the data is destined for SNL, IRIS, or SMU, DLMan interfaces to an AlphaDLHeap program running on an external machine.

4-119. The three programs supporting the data forwarding function are AlphaDLHeap, AlphaForward, and AlphaToDiode. There is one instance of AlphaDLHeap, one instance of AlphaToDiode, and three instances of AlphaForward residing on the Diskloop Server (dlsa). Figure 4-15 illustrates the processing environment for these programs.

4-120. AlphaDLHeap is the process which prepares inbound alpha packets for forwarding. AlphaDLHeap is started by the operator at system start-up and is intended to run indefinitely.

4-121. At start-up, AlphaDLHeap reads its `.par` file, reads the fwfile table, and opens a socket connection to each of the running DLMan processes. Once active, AlphaDLHeap takes packets from DLMan and writes them to a series of local heap files. There is one heap file per station per destination. For example, if there are 15 stations going to three destinations, then there are 45 individual heap files. The outbound data is replicated if it goes to more than one destination. AlphaDLHeap is intended to run indefinitely.

4-122. AlphaForward is the process which forwards data to alpha protocol-compliant destinations. AlphaForward is started by the operator at system start-up, usually through the facilities of the Launch program, and is intended to run indefinitely. There are three types of AlphaForward running. One sends heap file data from dtc2alpha and file2alpha to the local DLMan processes. The second sends alpha data to the IDC. The third sends alpha data to the US NDC Sustainment System.

4-123. At start-up, AlphaForward reads its local parameter file and the fwfile table. Once active, AlphaForward reads from the heap files and writes packets to the appropriate socket. There is one socket for each station/destination and AlphaForward does not open the socket connection until there is data to send for a particular station/destination. The read-write sequence for AlphaForward is round-robin style, across the heap files. In this way, all stations/destinations are treated with the same priority. The heap files are processed by AlphaForward in last-in-first-out (LIFO) order. The most recent arriving data has a higher priority for forwarding over older data already waiting in the heap files.

4-124. At start-up, AlphaToDiode reads its local parameter file, then the fwfile table opens a TCP/IP socket connection with the diode_send program running on the Diskloop Server. Once connected, AlphaToDiode reads from the heap files written by AlphaDLHeap for the Classified System and writes packets to the socket. The read-write sequence for AlphaToDiode is the same as for AlphaForward. In other words, the data is read round-robin style, across the heap files. In this way, the data is interleaved going to diode_send. The heap files are processed by AlphaToDiode in LIFO order. The most recent arriving data has

a higher priority for forwarding over older data already waiting in the heap files. AlphaToDiode is illustrated in figure 4-16.

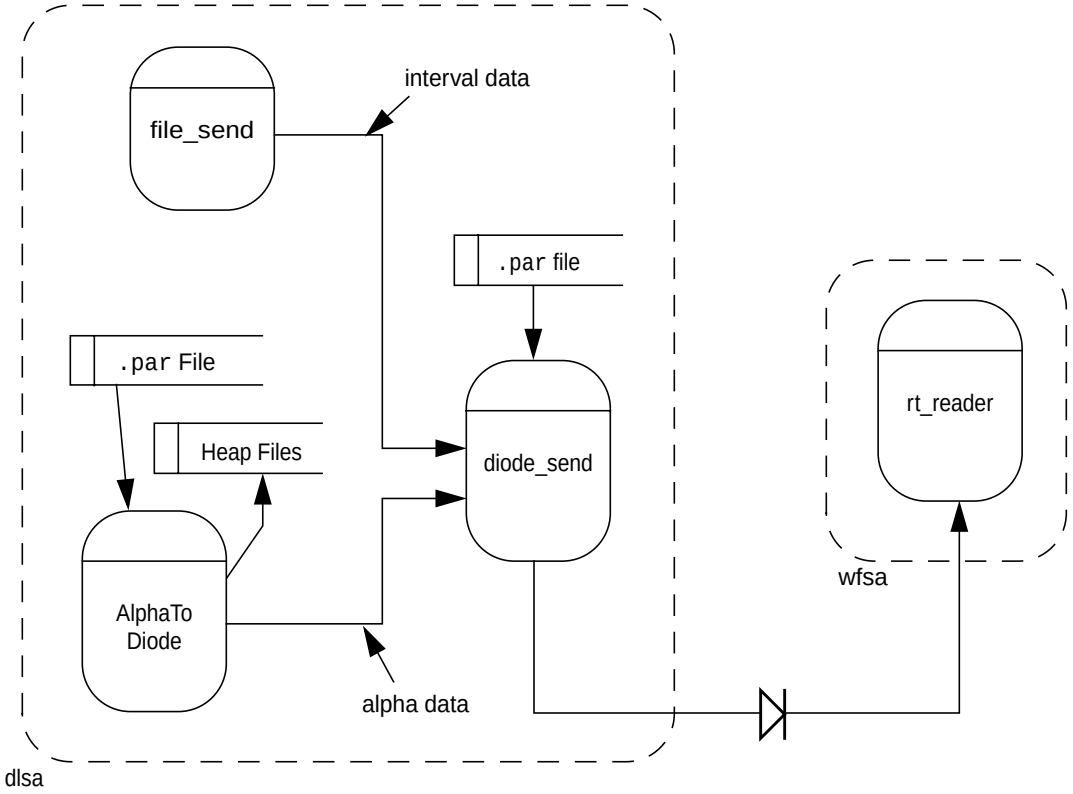

Figure 4-16. Processing Data to the Classified System

4-125. The program diode_send accepts TCP/IP socket connections from the AlphaToDiode and file_send programs. See figure 4-16. Once the connection is established, alpha packets are transmitted from these programs to diode_send.

4-126. The program diode_send is initiated by the operator at the time of system initialization and is not intended to terminate. There is a single copy of diode_send running on the Diskloop Server (dlsa).

4-127. At start-up, diode_send reads its local parameter file, opens a User Datagram Protocol/Internet Protocol (UDP/IP) socket for transmission across the Secure Diode link, and establishes which ports to listen to for incoming data. Then diode_send sends alpha packets across the Secure Diode link to an rt_reader process running on the Waveform Server in the Classified System. The UDP/IP connection is required since one-way transmission of data must be assured. The Secure Diode link obviates the use of the TCP/IP protocol since TCP/IP requires two-way communication. This is physically disallowed by the

diode and would constitute a security violation, if allowed. Upon accepting an inbound data packet, the packet is forwarded across the Secure Diode link to the Classified System.

4-128. UNCLASSIFIED ARCHIVE PROCESS.

4-129. The Unclassified Archive Subsystem provides long-term and permanent storage of the data received by the Data Acquisition Subsystem. See figure 4-17. The Unclassified Archive Subsystem consists of an Unclassified Archive/Database Server (uarch). The Unclassified Archive Server (uarch) has two disk farms and a DLT Robot. The first disk farm is RAID (Redundant Array of Independent Disks) storage. The second disk farm is on-line storage used by SAM-FS in conjunction with the DLT Robot and will be referred to as archive storage.

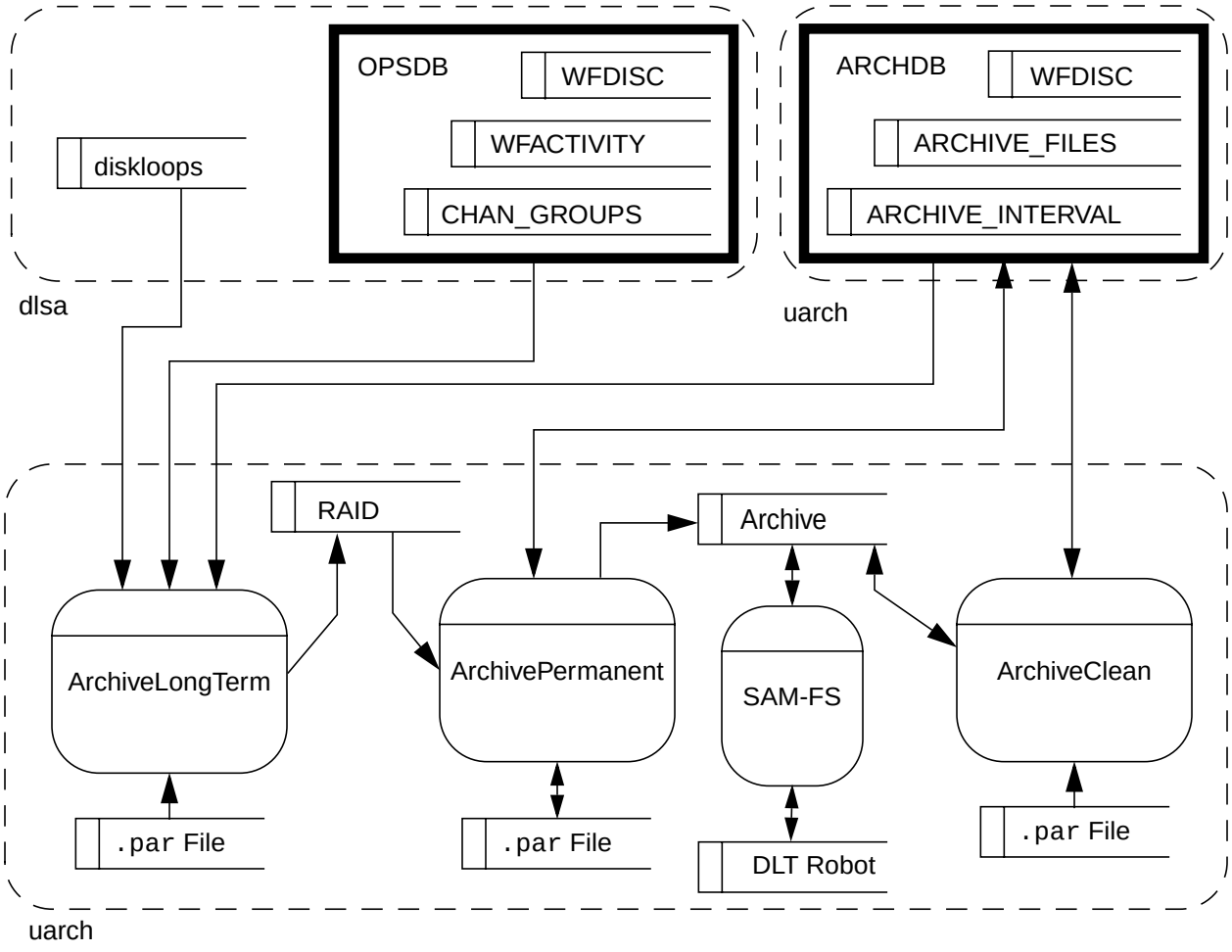

Figure 4-17. Unclassified System Data Archiving

4-130. ARCHIVELONGTERM.

4-131. The program ArchiveLongTerm is used to copy data from the diskloops to the RAID storage. Each file that ArchiveLongTerm creates in RAID storage contains two hours of compressed waveform data from all channels of a single station.

4-132. During the initialization phase, ArchiveLongTerm reads its `.par` file, establishes a connection to both the OPSDB and ARCHDB databases, and reads configuration information from the CHAN_GROUPS table. After initialization ArchiveLongTerm creates, updates, and deletes intervals in the ARCHIVE_INTERVAL table. The class of these intervals is CONTIN. Old intervals are deleted, new intervals are created, and existing intervals are updated based on information from the WFACTIVITY table. The final phase of operation is to copy waveform data to the RAID storage. Each interval represents a group of channels for a particular timeframe. The US NDC configuration has each station's channels grouped together into two-hour intervals.

4-133. ArchiveLongTerm looks for intervals which have reached a certain `.par` determined age, or are considered full (all data has been acquired) and copies the data associated with each interval to a file in the RAID storage. Each interval has a separate file associated with it. A record is created in the ARCHIVE_FILES table to connect the file to the interval record in the ARCHIVE_INTERVAL table. Table 4-2 shows all the states ArchiveLongTerm and ArchivePermanent use and the description of each state.

Table 4-2. Unclassified Archive Interval States

STATE	DESCRIPTION
empty	There is no data for this interval.
partial	There is some missing data for this interval.
full	There is no missing data for this interval.
archlong-started	ArchiveLongTerm has started to copy this data to RAID storage.
archlong-failed	ArchiveLongTerm encountered an error while trying to copy this interval to RAID storage.
archlong-done	ArchiveLongTerm successfully copied this interval to RAID storage.
emptydone	ArchiveLongTerm did not find any data to copy while working on this interval.
archperm-copy	ArchivePermanent is currently copying the file associated with this interval from RAID storage to the archive.
archperm-wait	ArchivePermanent is waiting for the files associated with this interval to be placed on DLT.

Table 4-2. Unclassified Archive Interval States (Cont)

STATE	DESCRIPTION
archperm-update	ArchivePermanent is waiting for the interval to reach a certain age (`.par` determined) before updating the wfdisc records to point to the archive file instead of the RAID file.
archperm-remove	ArchivePermanent is waiting for the interval to reach a certain age (`.par` determined) before removing the file in RAID storage.
archperm-failed	ArchivePermanent encountered an error while operating on this interval.
archperm-done	ArchivePermanent is done with this interval and it is completely archived.

4-134. ARCHIVEPERMANENT.

4-135. The program ArchivePermanent moves the files from RAID storage to archive storage. ArchivePermanent does this in stages, which ensures there is no possibility for data loss. During the initialization phase, ArchivePermanent reads its `.par` file and establishes a connection to the ARCHDB database. After initialization, ArchivePermanent creates and deletes intervals in the ARCHIVE_INTERVAL table. The class of these intervals is ARCHIVE. Old intervals are deleted and new intervals are created. In the last phase of operation, ArchivePermanent looks at each ARCHIVE and associated (by time) CONTIN intervals to see if they can be advanced to the next state.

4-136. Initially, files associated with archlong-done intervals are copied from RAID storage to archive storage. Only archlong-done intervals older than a `.par` determined time will be copied. Once the intervals file is copied, its state is changed to archperm-wait.

4-137. Every time ArchivePermanent runs, it looks at each file associated with intervals in the archperm-wait state and checks to see if the file has been placed on a DLT tape by SAM-FS. When ArchivePermanent has determined that a file is on tape, it will update the associated interval's state to archperm-update.

4-138. When an interval in the archperm-update state reaches a `.par` determined age, the wfdisc records in the ARCHDB database associated with that interval are updated to point to the file in archive storage instead of the file in RAID storage. Once this is done, the state of the interval is changed to archperm-remove.

4-139. When an interval in the archperm-remove state reaches a `.par` determined age, its associated file in RAID storage is removed and the associated interval record is updated to the archperm-done state. When all the CONTIN class intervals are updated to the archperm-done state, the ARCHIVE_FILES records are updated so they are associated to

the single ARCHIVE class interval. This is done so that when the CONTIN class intervals are deleted ArchiveClean can still determine what to remove.

4-140. ARCHIVECLEAN.

4-141. The program ArchiveClean removes old files from archive storage to maintain only the most recent 180 days of data in archive storage. Once started, ArchiveClean enters its initialization phase, reads its `.par` file, and establishes a connection to the ARCHDB database. After initialization, ArchiveClean finds ARCHIVE class intervals older than a `.par` determined age and removes the intervals, their associated ARCHIVE_FILES records, and their associated file in archive storage.

SECTION IV

CLASSIFIED ANALYSIS SYSTEM PROCESSES AND DATA FLOW

4-142. GENERAL.

4-143. The Classified System performs the following four principal functions:

a. Data Acquisition

b. Waveform Analysis (discussed in section V)

c. Waveform Evaluation (discussed in section V)

d. Waveform and Analysis Products Archiving

4-144. DATA ACQUISITION.

4-145. The process for receipt of alpha protocol data is similar to that found on the Unclassified System. Connections are requested by a ConnMan process (spawned by a sockd demon) originating from the Waveform Server (wfsa). The response to the request is the address of the DLMan process which will accept the alpha packets. The differences lie in the following:

a. All data acquisition processing takes place in the Waveform Server (wfsa).

b. There are six DLMan processes running on the Waveform Server.

4-146. DATA SOURCES.

4-147. The three distinct data inputs to the Classified System are as follows:

a. Unclassified Waveform Data

b. Interval Data

c. Classified Hydro Data

4-148. UNCLASSIFIED WAVEFORM DATA. Unclassified waveform data is transferred to the Classified System Waveform Server from the Unclassified System via the Secure Diode link.

4-149. INTERVAL DATA. Unclassified interval data is transferred to the Classified System from the Unclassified System via the Secure Diode link.

4-150. CLASSIFIED HYDRO DATA. Hydro data from classified stations is received by the Classified System in the Waveform Server (wfsa). Once the connection is established, waveform data, compliant with the alpha protocol, is received. The DLMan process, running on the Waveform Server (wfsa), accepts the data forwarded by AlphaNode and processes the data into the Classified Data Acquisition Subsystem. Figure 4-18 illustrates this data interface.

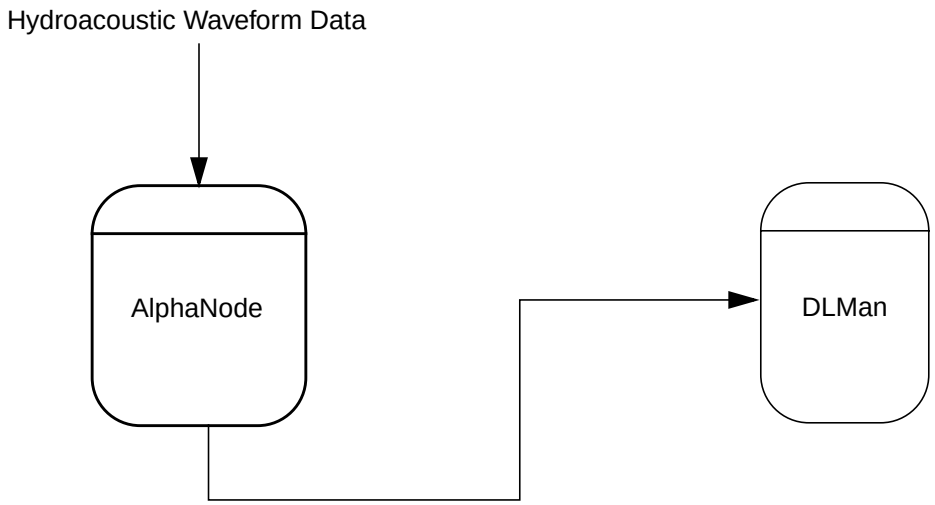

Figure 4-18. Classified Hydro Data Interface through AlphaNode

4-151. DATA DESTINATIONS.

4-152. For security reasons, no waveform or data products are output from the Classified System. The only output allowed is a Group of Scientific Experts (GSE) 2.0-formatted email message which is sent from the Classified System to the Unclassified System. This minimal interface, used to support gap handling, is effected across the Classified C2 Guard. The C2 Guard is an accredited system for transferring alphanumeric text files from a high security to a low security system.

4-153. The classified gap handling component attempts to fill data gaps automatically. It reads data frame logs from the Classified Data Acquisition Subsystem component or receives manual requests from the DAM, attempts to determine if there is missing data, and provides an outage report that is then transferred to the C2 Guard.

4-154. DATA TRANSFER.

4-155. Within the data acquisition processing, UDP/IP packets are sent across the Secure Diode link to the rt_reader program which places them into a shared memory buffer. These

special format packets are then read from shared memory by diode_recv and re-assembled into diode protocol packets. The diode protocol packets are then fed by diode_recv to its two clients: DiodeToAlpha and file_recv. The program DiodeToAlpha performs the conversion from the diode protocol to alpha protocol and places the alpha protocol packets into an appropriate heap file. The file_recv program converts diode packets into files, one file per packet. This interface is illustrated in figure 4-19.

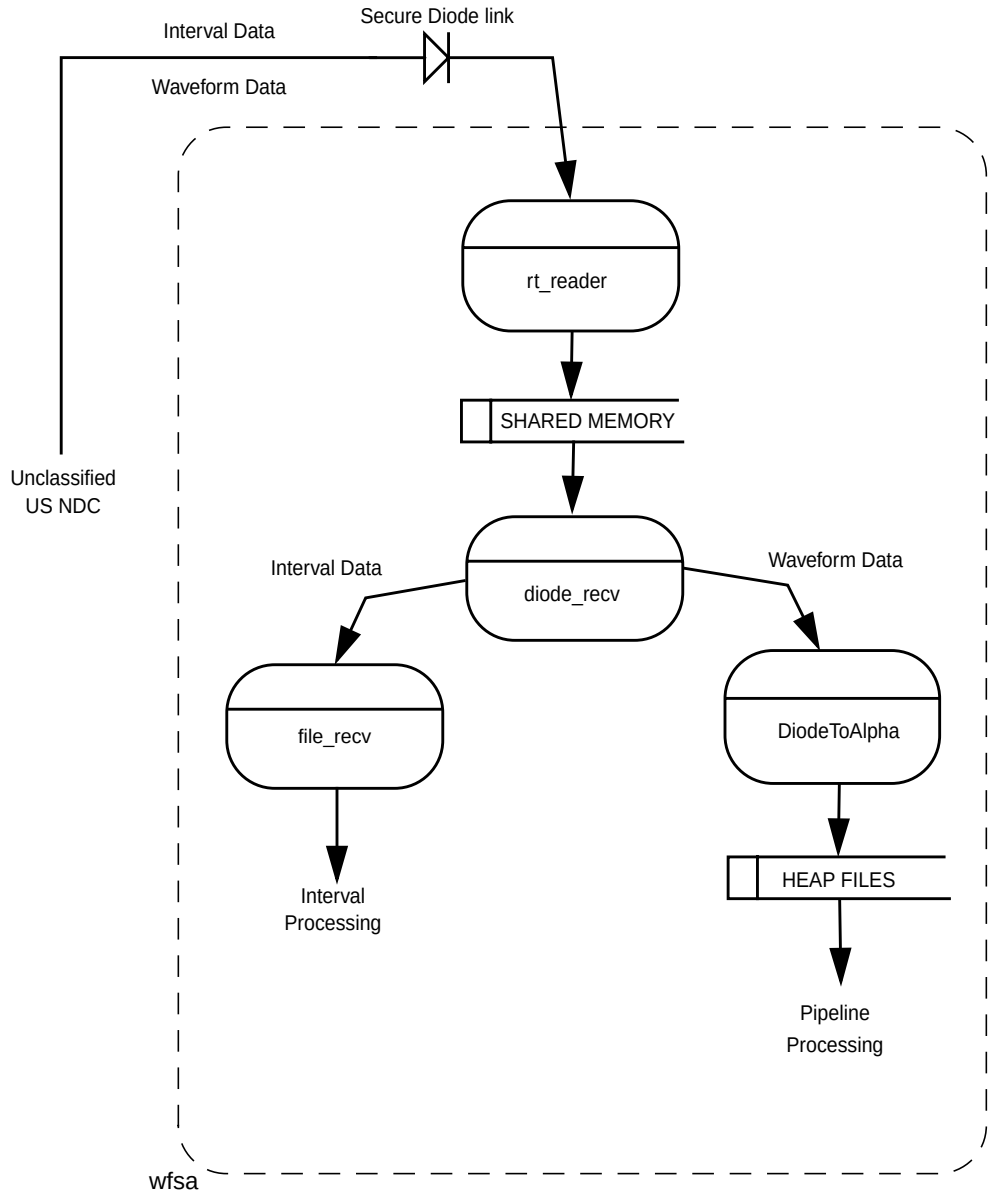

Figure 4-19. Unclassified to Classified Data Transfer

4-156. INTERVAL PROCESSING.

4-157. Interval information is generated on the Unclassified System and transferred to the Classified System. Once in the Classified System this interval information is made available for display by the classified data acquisition WorkFlow.

4-158. When the interval information is sent to the Classified System by the Unclassified System, it is received by the file_recv process (refer to paragraph 4-154 for more details) and placed into ASCII files. The recv_interval program reads these ASCII files and makes the appropriate updates to the INTERVAL table in the database on the Pipeline DB Server. The update_interval process checks the database and determines the station's timeframe from the data, and updates the interval table corresponding to the original station data. The classified data acquisition WorkFlow GUI displays this interval information from the INTERVAL table along with the interval information generated by the update_interval process. This entire process is illustrated in figure 4-20.

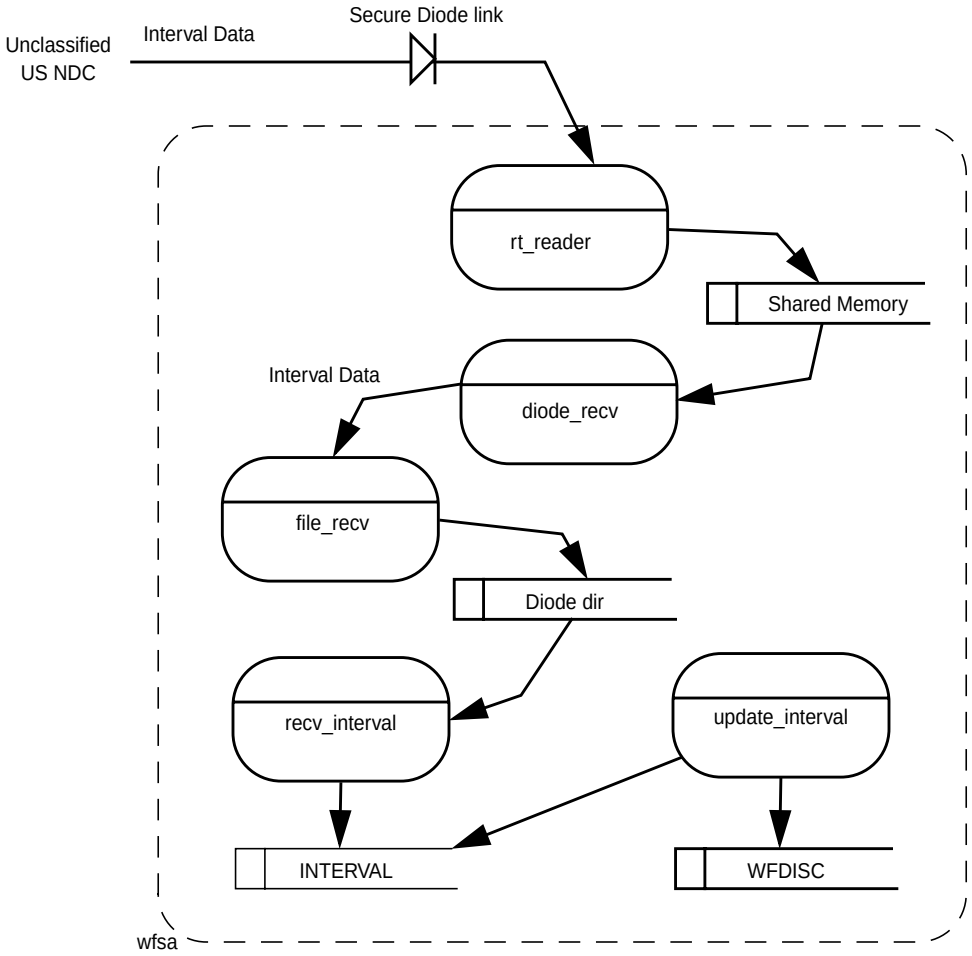

Figure 4-20. Interval Data Processing

4-159. CLASSIFIED ARCHIVE PROCESS.

4-160. The Classified Archive Subsystem provides long-term and permanent storage of the data received by the Analysis Subsystem. The Classified Archive Subsystem (figure 4-21) consists of a Classified Archive/Database Server (carch). The Archive/DB Server (carch) has two disk farms and a DLT 8-tape autochanger. The first disk farm is RAID storage. The second disk farm is on-line storage used by SAM-FS in conjunction with the DLT 8-tape autochanger and will be referred to as archive storage.

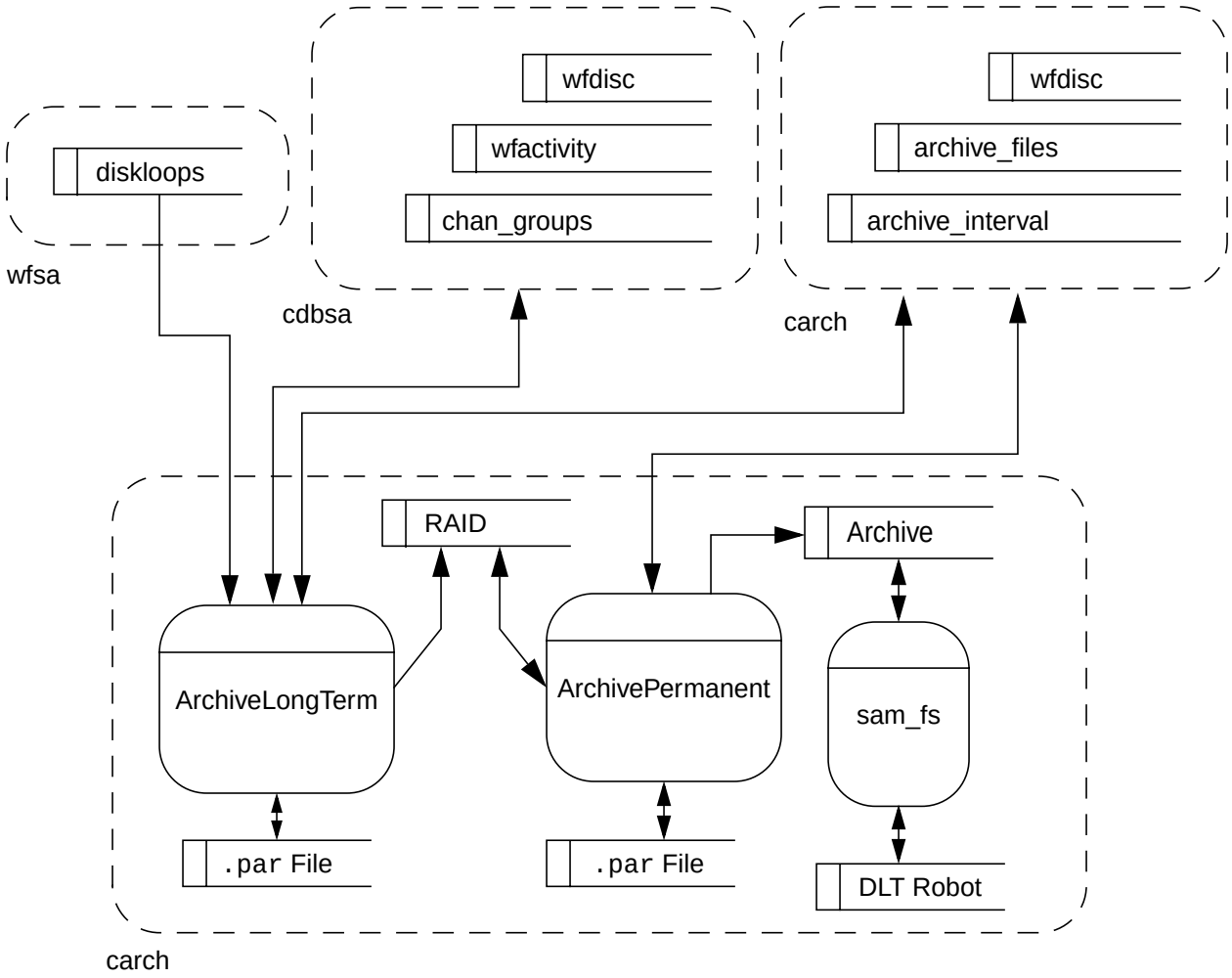

Figure 4-21. Classified System Data Archiving

4-161. ARCHIVELONGTERM.

4-162. The program ArchiveLongTerm is used to copy data from the diskloops to the RAID storage. Each file ArchiveLongTerm creates in RAID storage contains two hours of compressed waveform data from all channels of a single station.

4-163. During the initialization phase, ArchiveLongTerm reads its `.par` file, establishes a connection to both the OPSDB and ARCHDB databases, and reads configuration information from the CHAN_GROUPS table. After initialization, ArchiveLongTerm creates, updates, and deletes intervals in the ARCHIVE_INTERVAL table. The class of these intervals are CONTIN, SEGMENT and BEAM. Old intervals are deleted, new intervals are created, and existing intervals are updated based on information from the WFACTIVITY table. The final phase of operation is to copy waveform data to the RAID storage. Each interval represents a group of channels for a particular timeframe. The US NDC configuration has each station's channels grouped together into two-hour CONTIN class intervals.

4-164. During the initialization phase, ArchiveLongTerm reads its `.par` file, establishes a connection to both the OPSDB and ARCHDB databases, and reads configuration information from the CHAN_GROUPS table. After initialization, ArchiveLongTerm creates, updates, and deletes intervals in the ARCHIVE_INTERVAL table. The class of these intervals are CONTIN, SEGMENT and BEAM. Old intervals are deleted, new intervals are created, and existing intervals are updated based on information from the WFACTIVITY table. The final phase of operation is to copy waveform data to the RAID storage. Each interval represents a group of channels for a particular timeframe. The US NDC configuration has each station's channels grouped together into two-hour CONTIN class intervals.

Table 4-3. Classified Archive Interval States

STATE	DESCRIPTION
empty	There is no data for this interval.
partial	There is some missing data for this interval.
full	There is no missing data for this interval.
archlong-started	ArchiveLongTerm has started to copy this data to RAID storage.
archlong-failed	ArchiveLongTerm encountered an error while trying to copy this interval to RAID storage.
archlong-done	ArchiveLongTerm successfully copied this interval to RAID storage.
emptydone	ArchiveLongTerm did not find any data to copy while working on this interval.
archperm-copy	ArchivePermanent is currently copying the file associated with this interval from RAID storage to the archive.

Table 4-3. Classified Archive Interval States (Cont)

STATE	DESCRIPTION
archperm-wait	ArchivePermanent is waiting for the files associated with this interval to be placed on DLT.
archperm-update	ArchivePermanent is waiting for the interval to reach a certain age (`.par` determined) before updating the wfdisc records to point to the archive file instead of the RAID file.
archperm-remove	ArchivePermanent is waiting for the interval to reach a certain age (`.par` determined) before removing the file in RAID storage.
archperm-failed	ArchivePermanent encountered an error while operating on this interval.
archperm-done	ArchivePermanent is done with this interval and it is completely archived.

4-165. ARCHIVEPERMANENT.

4-166. The program ArchivePermanent moves the files from RAID storage to archive storage. ArchivePermanent does this in stages, which ensures there is no possibility for data loss. During the initialization phase, ArchivePermanent reads its `.par` file and establishes a connection to the ARCHDB database. After initialization, ArchivePermanent creates and deletes intervals in the ARCHIVE_INTERVAL table. The class of these intervals is ARCHIVE. Old intervals are deleted and new intervals are created. In the last phase of operation, ArchivePermanent looks at each ARCHIVE and associated (by time) CONTIN, SEGMENT, and BEAM intervals to see if they can be advanced to the next state.

4-167. Initially, files associated with archlong-done intervals are copied from RAID storage to archive storage. Only archlong-done intervals older than a `.par` determined time will be copied. Once the intervals file is copied, its state is changed to archperm-wait.

4-168. Every time ArchivePermanent runs, it looks at each file associated with intervals in the archperm-wait state and checks to see if the file has been placed on a DLT tape by SAM-FS. When ArchivePermanent has determined that a file is on tape, it will update the associated interval's state to archperm-update.

4-169. When an interval in the archperm-update state reaches a `.par` determined age, the wfdisc records, in the ARCHDB database associated with that interval, are updated to point to the file in archive storage instead of the file in RAID storage. Once this is done, the state of the interval is changed to archperm-remove.

4-170. When an interval in the archperm-remove state reaches a `.par` determined age, its associated file in RAID storage is removed and the associated interval record is updated to the archperm-done state. When all the CONTIN, SEGMENT and BEAM class intervals are updated to the archperm-done state, the ARCHIVE_FILES records are updated so they are associated to the single ARCHIVE class interval.

SECTION V

CLASSIFIED ANALYSIS SUBSYSTEM PIPELINE PROCESSES AND DATA FLOW

4-171. INTRODUCTION.

4-172. This section outlines the general data and processing flow for the numerous interactive analysis stages and automated processes used by the system. A brief description of the basic purpose of each stage or process, the corresponding input and output data, and a process flow diagram is provided. The input and output section lists the information and data for each analysis or processing stage, and the output the analysis or processing stage is expected to produce

4-173. A pipeline is a sequence of processes to be applied to a data stream. Such a sequence of processes requires a control mechanism to schedule the component processes and to monitor them for successful completion and take corrective action in case of a failure. In addition, some processes may not be running when initially requested and need to be started. A process needs to be restarted if it has failed. Therefore, the entire pipeline is divided into stages, each with internal controls. Each automated pipeline stage contains at least two of the process types described in the following paragraphs.

4-174. The Pipeline Launch and WorkFlow displays provide control and status information to the SOM as needed for management of the processing pipelines.

4-175. The Distributed Applications Control System (DACS) Manager (dman) is responsible for starting all pipeline processes not normally started by the operator from the Pipeline Launch interface. The dman process starts the Communications Agent (CommAgent), PM, and all application shells as they are needed during processing.

4-176. The CommAgent process is a component of DACS and provides a logical store-and-forward service for messages. The CommAgent intercepts message sends, stores the message in a message queue, translates the logical name of the recipient to a physical name, notifies the message recipient, and then delivers the messages when requested by the recipient. Each CommAgent is given a group name. Applications register themselves with a particular CommAgent.

4-177. The data received at the Classified System is processed differently according to the data type and the goal of the processing. Processing is accomplished with a number of pipelines, each of which is characterized by the set of processes involved and the database accounts used. The main purpose of each pipeline is summarized as follows:

4-178. The data received at the Classified System is processed differently according to the data type and the goal of the processing. Processing is accomplished with a number of

pipelines, each of which is characterized by the set of processes involved and the database accounts used. The main purpose of each pipeline is summarized as follows:

a. The Global pipeline builds a global bulletin with short period (SP) and long period (LP) seismic data and performs classification for events of interest using seismic data and using hydroacoustic arrivals associated with offshore events.

b. Broad Area Regional Monitoring (BARM) processing pipeline builds a bulletin for a specifically defined geographic region using seismic data recorded at selected stations located at teleseimic and regional distances from the area of interest.

c. The Spotlight pipeline builds a regional bulletin for specified areas and estimates regional magnitude.

d. The Look-Forward pipeline provides rapid notification of events in configurable, pre-defined target areas and validates and refines target events on an accelerated schedule, making the data available for rapid analysis.

e. Hydroacoustic detects and identifies hydroacoustic phases with high signal-to-noise ratios (SNRs).

4-179. The pipelines include both automated processing and interactive analysis stages. An automated process follows each analysis stage in the Global pipeline to prepare the data suite for the next stage of analysis.

4-180. GLOBAL PIPELINE.

4-181. The Global pipeline transforms raw waveform data into alphanumeric event data in ten stages of automated and interactive data processing. Figure 4-22 shows the data flow within the Global pipeline.

4-182. Waveform and alphanumeric data is run through the first two stages of the pipeline to detect signals and to form preliminary events. These automated processes are referred to as station and network processing, respectively. The resulting automated bulletin is then analyzed by the first and second Seismic Event Analyst (SEA1, SEA2) and then by the first and second Event Evaluation Analyst (EEA1, EEA2). Each of the four analysis stages is followed by a stage of post-analysis processing (e.g., AUTO-AL1) to make-up the final eight stages of the Global pipeline. In addition, the evaluation stages include automated processing (AUTO-EVAL1) which is run after analyst review and before discrimination analysis (Discrim processing).

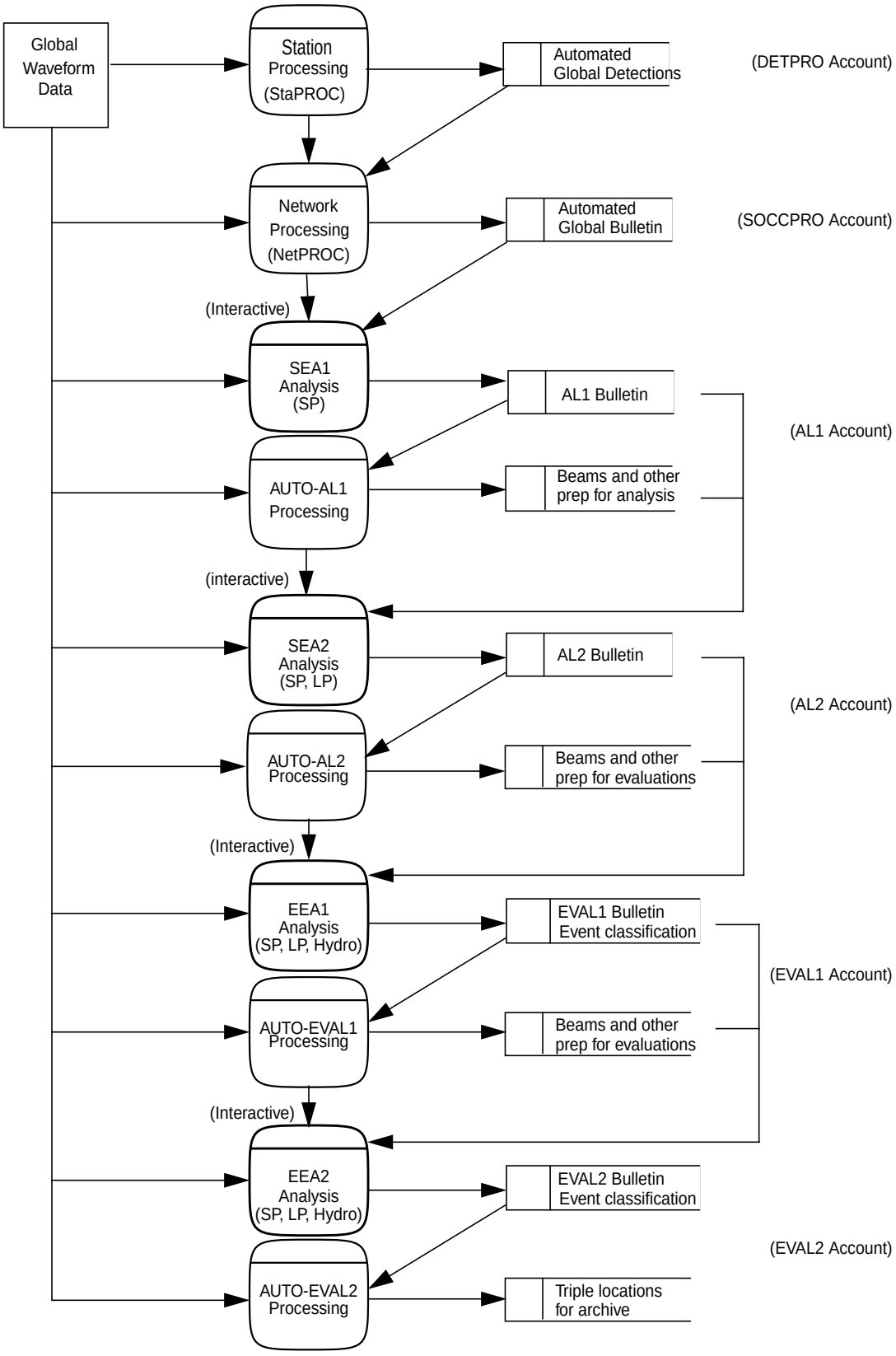

Figure 4-22. Data Flow

4-183. GLOBAL STATION PROCESSING.

4-184. Global station processing is the first stage of the Global pipeline. Global station processing (figure 4-23) runs against seismic station intervals (SEIS) and treats each seismic station in isolation, making detections, measurements, and beams according to the properties of the detections themselves. In other words, information based on the network about events is not yet available at this stage. Global station processing accomplishes all processing which can be done at the station level.

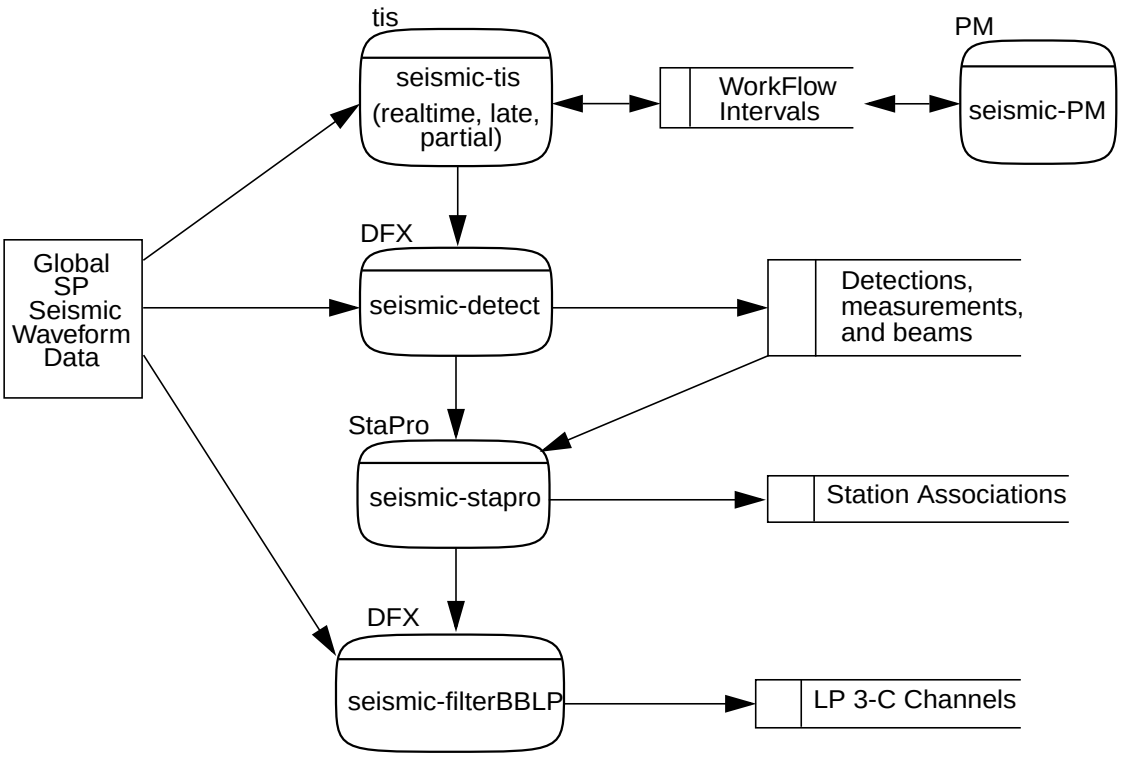

Figure 4-23. Global Station Processing Data Flow Diagram

4-185. The seismic-tis-realtime process monitors the incoming raw data in a candidate 15-minute time interval for a station. It creates a SEIS interval with a state of queued in the global database account and initiates processing on the interval when a parameter-determined percentage of the interval is covered by at least one station channel. If a candidate interval does not become filled to the specified percentage but it is more than 15 percent filled, then seismic-tis-realtime creates a partial interval. If the candidate interval does not become 15 percent filled, then seismic-tis-realtime creates a skipped interval.

4-186. When approximately ten minutes have elapsed since a partial interval was created, which gives the Data Acquisition Subsystem a finite amount of time to fill-in the time interval, seismic-tis-partial updates the state of the interval to pending, and seismic-tis-realtime

initiates processing on the interval. If a skipped interval becomes more than 15 percent filled, seismic-tis-late updates the state of the interval to pending or partial, as appropriate, and seismic-tis-realtime initiates processing on the interval.

4-187. The seismic-PM process schedules and controls the following sequence of processes to be run on each SEIS interval marked queued by the seismic-tis-realtime process. As the processing is performed, the PM updates the state of the interval to show the current active process in the sequence. When processing is completed, seismic-PM sets the state of the interval to station-done. If one of the processes fails, seismic-PM will attempt to rerun the process. If the process fails a second time, seismic-PM will set the state of the interval to failed.

4-188. The seismic-detect process creates arrival records for valid signals detected on seismic stations. These records contain information such as the arrival onset time, SNR, amplitude, and period. It then attempts to generate a five-minute arrival beam around each arrival, to correspond to the feature measurements made on the arrivals. For array stations, the beam is based on the azimuth and slowness determined from the fk spectrum of the arrival. When there is not enough waveform data to generate a full five-minute beam, it is left to the network processing stage of the Global pipeline to generate the arrival beams. For ASN stations, detection processing will normally run against the broadband (BB) waveform data for the station. If there is no BB data for an ASN station interval, the detection processing will run against the available SP data instead.

4-189. The seismic-stapro process groups together arrivals for each station reasonably presumed to have a common origin. The grouping together of arrivals is made on the basis of azimuth and slowness for array and three-component sites, as well as on the basis of time of arrival for single-component stations. This station grouping lessens the likelihood that network association processing will create false multiple events using later arrivals from a single origin.

4-190. The seismic-filterBBLP process applies filters to derive true LP waveforms from BB waveforms for stations which do not transmit the LP channels. In most cases, the center element of each LP array is transmitted as a BB channel, making it unsuitable for LP interpretation. This process creates LP channels consistent with the other LP array elements, suitable for interpretation of LQ (Love Wave) and LR (Raleigh Wave) surface waves. Only a subset of the stations in the global network are configured for this processing. For ASN stations, if there is no BB data for the station interval, the processing will convert the available SP data to BB data instead.

4-191. GLOBAL NETWORK PROCESSING.

4-192. Global network processing (NetPROC) is the second stage of the Global pipeline. Global network processing (figure 4-24) starts when enough station data has accumulated to form a network (NET) interval. The processing assembles the detection data from the available stations to produce event locations based on multiple stations.

4-193. The network-tin process monitors the number of processed station intervals in a candidate 30-minute time interval and creates a NET interval in the global database account when the number reaches the configured threshold. After an initial wait time of 40 minutes, network-tin creates the interval and initiates processing only when station processing has completed on most of the stations in the network. If not enough station processing has completed, network-tin drops the threshold and waits an additional five minutes before creating and processing the interval. This is repeated until the number of stations processed exceeds the threshold. If sufficient data is not received, the threshold drops below a reasonable level for an association of the available arrivals, at which point the candidate time interval is skipped.

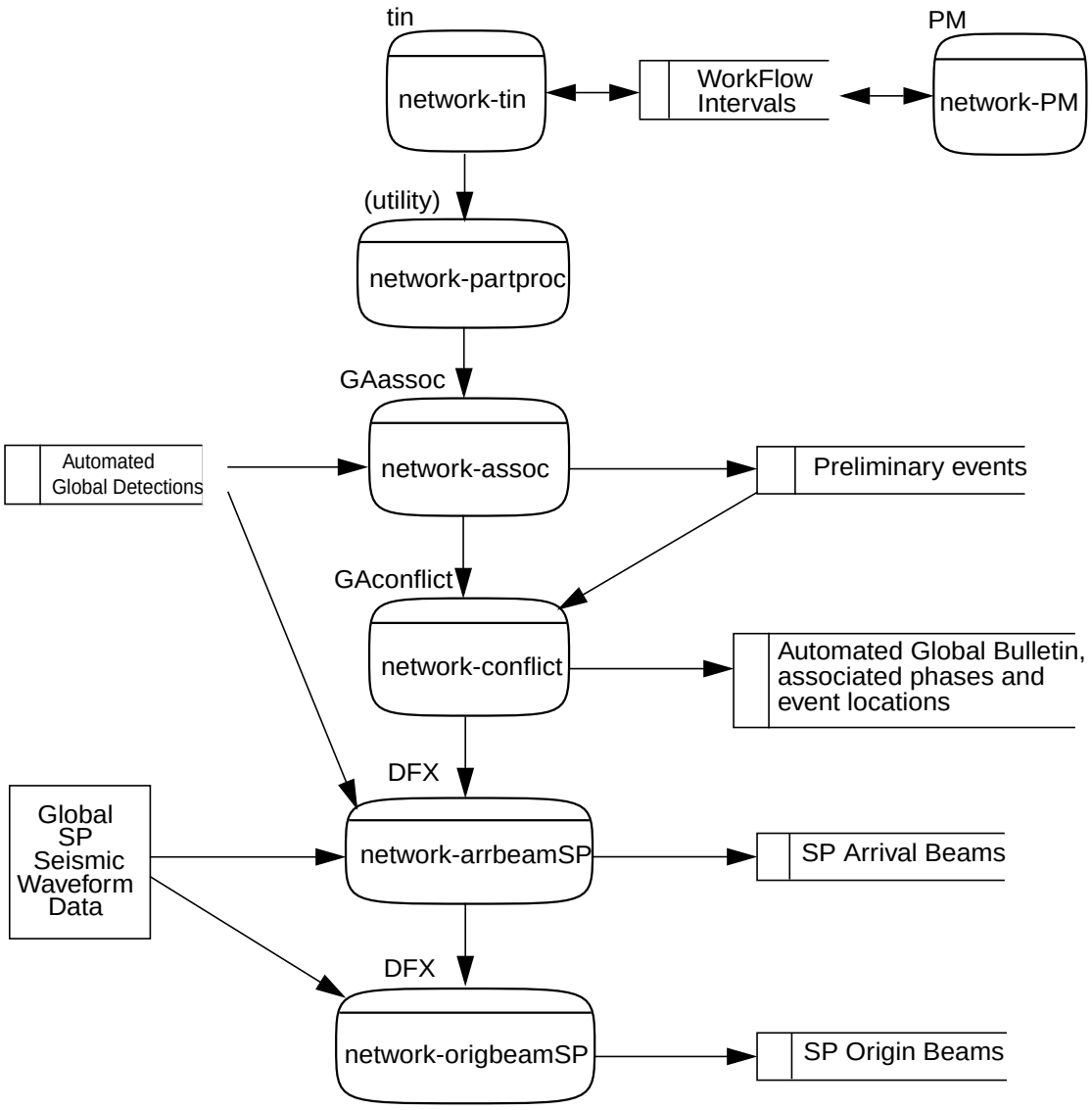

Figure 4-24. Global Network Processing Data Flow Diagram

4-194. The network-PM process schedules and controls the following sequence of processes to be run on each NET interval marked queued by the network-tin process. As the processing is performed, the PM updates the state of the interval to show the current active process in the sequence. When processing is complete, network-PM sets the state of the interval to network-done. If one of the processes other than the network-conflict process fails, network-PM will attempt to rerun the process. If the process fails a second time, seismic-PM will set the state of the interval to failed.

4-195. The network-partproc process initiates station processing on all partial station intervals within the network interval. When the seismic-tis-realtime process determines an interval is less than 100 percent filled, it creates a partial interval. While normally a waiting period will elapse before the interval is processed to allow data acquisition additional time to receive any available data, network-partproc is used to stop the wait so station processing will proceed on the partial intervals. Then network-partproc will wait up to five minutes for any active station processing within the network interval to complete.The network-partproc process initiates station processing on all partial station intervals within the network interval. When the seismic-tis-realtime process determines an interval is less than 100 percent filled, it creates a partial interval. While normally a waiting period will elapse before the interval is processed to allow data acquisition additional time to receive any available data, network-partproc is used to stop the wait so station processing will proceed on the partial intervals. Then network-partproc will wait up to five minutes for any active station processing within the network interval to complete.

4-196. The network-assoc (GAassoc) and network-conflict (GAconflict) processes are collectively known as Global Association (GA). The network interval processed represents the time period of arrivals to be associated together. A look-back of 20 minutes is applied by GA to the start-time of the interval to account for the event origin times of any associated arrivals in the interval. GA produces seismic origins by associating three or more station detections, then writes the results to the soccpro database account.

4-197. The network-assoc process associates seismic detections to events and locates the events. It takes the detection data provided by station processing and uses an algorithm to group the detections into events. The output is a preliminary set of event data stored in the working tables origin_ga, origerr_ga, and assoc_ga for refinement by the network-conflict process.

4-198. The network-conflict process resolves conflicts between the set of events contained in the working tables produced by network-assoc and the set of events found in the output origin, origerr, and assoc tables. Resolutions are made for events which overlap and detections associated to the wrong event. While resolving conflicts, it also adds defining phases to events where the detections fall within parameters. It then sends the results to the origin, origerr, and assoc database tables.

4-199. When the network-assoc process first becomes active, it changes the state of the set of station processing time intervals covered by the network processing time interval from station-done to assoc-started. This shows which station processing intervals were

completed in time for incorporation into the event bulletin produced by network processing. When the network-conflict process completes, it changes the state of the same set of station processing intervals to network-done. Station processing intervals which did not complete in time for network processing will not change from station-done to network-done unless there were no arrivals produced by the processing.

4-200. The network-abeamSP process creates arrival beams for arrivals which do not already have beams. In station processing, arrival beams are configured to be five minutes long, and sometimes there may not be enough data to form a beam for a given arrival. The network-arrbeamSP process relaxes the five-minute requirement and creates arrival beams from whatever waveform data is available. Forming some of the arrival beams during network processing allows data acquisition additional time to receive any available data, so potentially a greater percent of the arrival beams will be five minutes long.

4-201. The network-obeamSP process forms SP origin beams for non-detecting stations for the set of events covered by a network interval. The term origin beam is used to indicate a beam whose parameters are based upon the location of the defining event, rather than on the characteristics of an arrival. In the absence of any other information, the origin beam should be optimal for detection of arrivals from that origin. The processing determines the theoretical time for arrivals expected from each event/station pair for the stations which do not have an initial P detection associated to the event, and then forms the beam from waveform data around the theoretical time.

4-202. SEA1 ANALYSIS.

4-203. SEA1 analysis is the third stage of the Global pipeline. The primary goal in SEA1 analysis (figure 4-25) is to review and refine the event solutions generated by the automated processing system using all available SP data. When global network processing has completed five 30-minute intervals, the SEA1 analyst can begin to process the two-hour block covering the first four of the network intervals. The SEA1 analyst starts with a read of the data into the Analyst Review Station (ARS), which creates an ARS al1 interval. The analyst reviews the events formed by network processing and refines arrival and event data as necessary. When the SEA1 analyst issues the Save Data command, ARS saves the remaining unassociated arrivals to the al1 account, automatically creates a post-analyst processing AUTO-AL1 interval in the global account, and initiates AUTO-AL1 processing on the interval.

4-204. The input to SEA1 analysis is the Automated Global Bulletin in the soccpro database account (accessed through the in_* synonyms in the al1 account) and any results which were saved in the al1 account during a previous SEA1 analysis session for the same interval or for the adjacent intervals. Information in the al1 account regarding a particular event, arrival, etc., takes precedence over the same information found in the soccpro account.

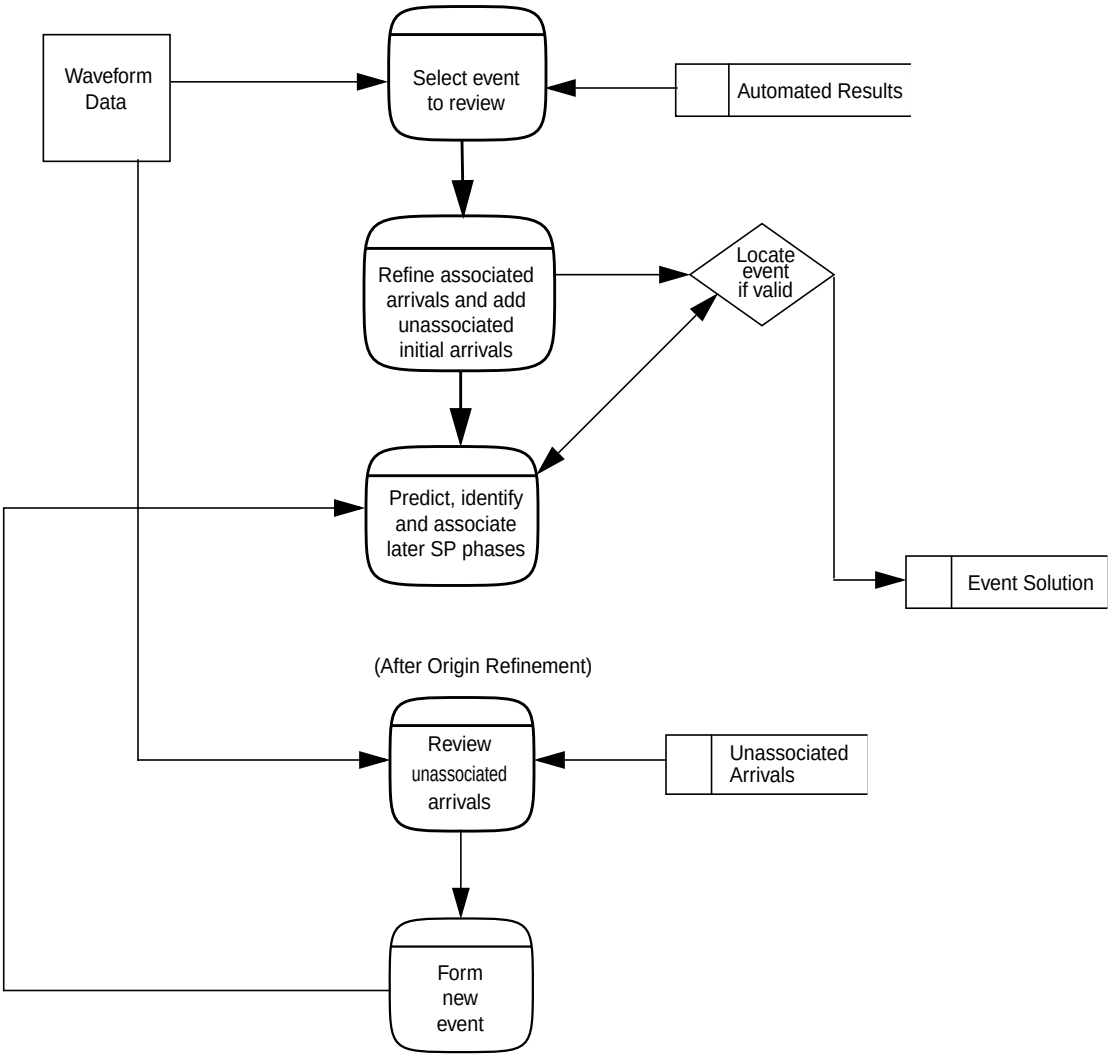

Figure 4-25. SEA1 Analysis Process Flow Diagram

4-205. In SEA1 analysis, event solutions are obtained using a multi-stage iterative procedure during which the origins are refined and augmented by:

a. Locating the event.

b. Adjusting existing detections (e.g., associating, re-timing, renaming).

c. Adding new detections.

d. Relocating the event to include the additional/modified information.

e. Verifying the additional/modified information is consistent with the event.

4-206. AUTO-AL1 PROCESSING.

4-207. AUTO-AL1 processing is the fourth stage of the Global pipeline. AUTO-AL1 processing (figure 4-26) prepares the input data for the SEA2 analyst by creating all necessary beams and measurements based on the results saved by the SEA1 analyst.

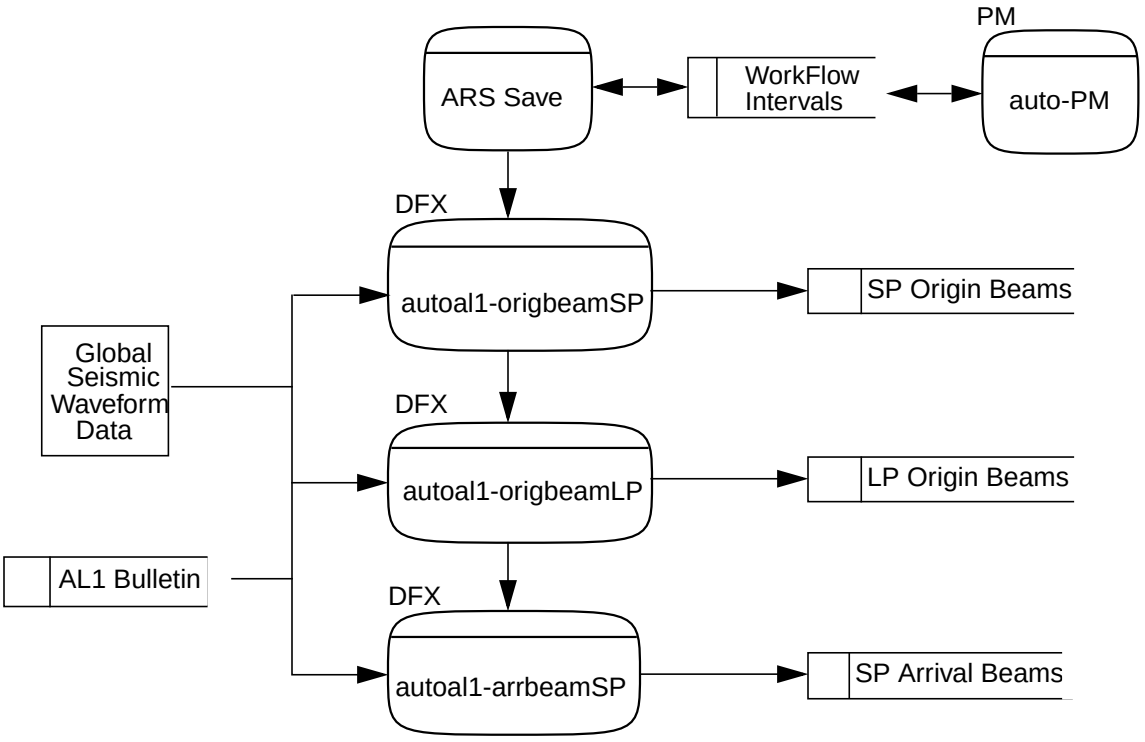

Figure 4-26. AUTO-AL1 Processing Data Flow Diagram

4-208. The auto-PM process schedules and controls the following sequence of processes to be run on each AUTO-AL1 interval in the global database account marked queued by ARS. As the processing is performed, auto-PM updates the state of the interval to show the current active process in the sequence. When processing is completed, auto-PM sets the state of the interval to done. If one of the processes fails, auto-PM will attempt to rerun the process. If the process fails a second time, auto-PM will set the state of the interval to failed.

4-209. The autoal1-origbeamSP process creates SP origin beams for new events which were formed by the SEA1 analyst and updates any existing origin beams to account for potentially significant differences in beam-steering resulting from changes in event locations. The analyst does not save any origin beams, since they are efficiently created in the post-analysis processing. The processing makes noise P phases and measures the noise amplitude and period at the theoretical time for non-detecting stations in the appropriate distance range. The noise statistics are used to help define the maximum-likelihood body-wave magnitude for an event.

4-210. The autoal1-origbeamLP process creates LP origin beams around the predicted arrival times of the LQ and LR surface wave phases for the origins saved in the al1 account. Vertical and transverse beams are created for analysis of LR and LQ waves, respectively.

4-211. The autoal1-arrbeamSP process creates arrival beams for arrivals which do not already have beams. The arrival beams are configured to be five minutes long, but when there is not enough data to create a five-minute beam for a given arrival, it will create the beam from whatever waveform data is available. The analyst does not save any arrival beams, since they are efficiently created in the post-analysis processing.

4-212. SEA2 ANALYSIS.

4-213. SEA2 analysis is the fifth stage of the Global pipeline. The primary goal in SEA2 analysis is to review and refine the event solutions generated by the SEA1 analyst. SEA2 analysis (figure 4-27) differs from SEA1 analysis primarily in that the SEA2 analyst is provided LP data to work with in addition to the SP data. SEA2 analysis includes all of the steps in SEA1 analysis plus the additional steps required to add LP detections and the associated amplitude and period measurements. The SEA2 analyst starts with a read of the data into ARS which creates an ARS al2 interval in the global database account. The analyst reviews the events formed by the SEA1 analyst and refines arrival and event data as necessary. When the SEA2 analyst issues the Save Data command, ARS saves the remaining unassociated arrivals to the al2 account, automatically creates a post-analyst processing AUTO-AL2 interval in the global account, and initiates AUTO-AL2 processing on the interval'

4-214. The input to SEA2 analysis is the SEA1 Bulletin in the al1 database account (accessed through the in_* synonyms in the al2 account) and any results which were saved in the al2 account during a previous SEA2 analysis session for the same interval or for the adjacent intervals. Information in the al2 account regarding a particular event, arrival, etc., takes precedence over the same information found in the al1 account.

4-215. In SEA2 analysis, event solutions are obtained using a multi-stage iterative procedure during which the origins are refined and augmented by:

a. Locating the event.

b. Adding new detections (late data).

c. Relocating the event to include the additional/modified information.

d. Verifying the additional/modified information is consistent with the event.

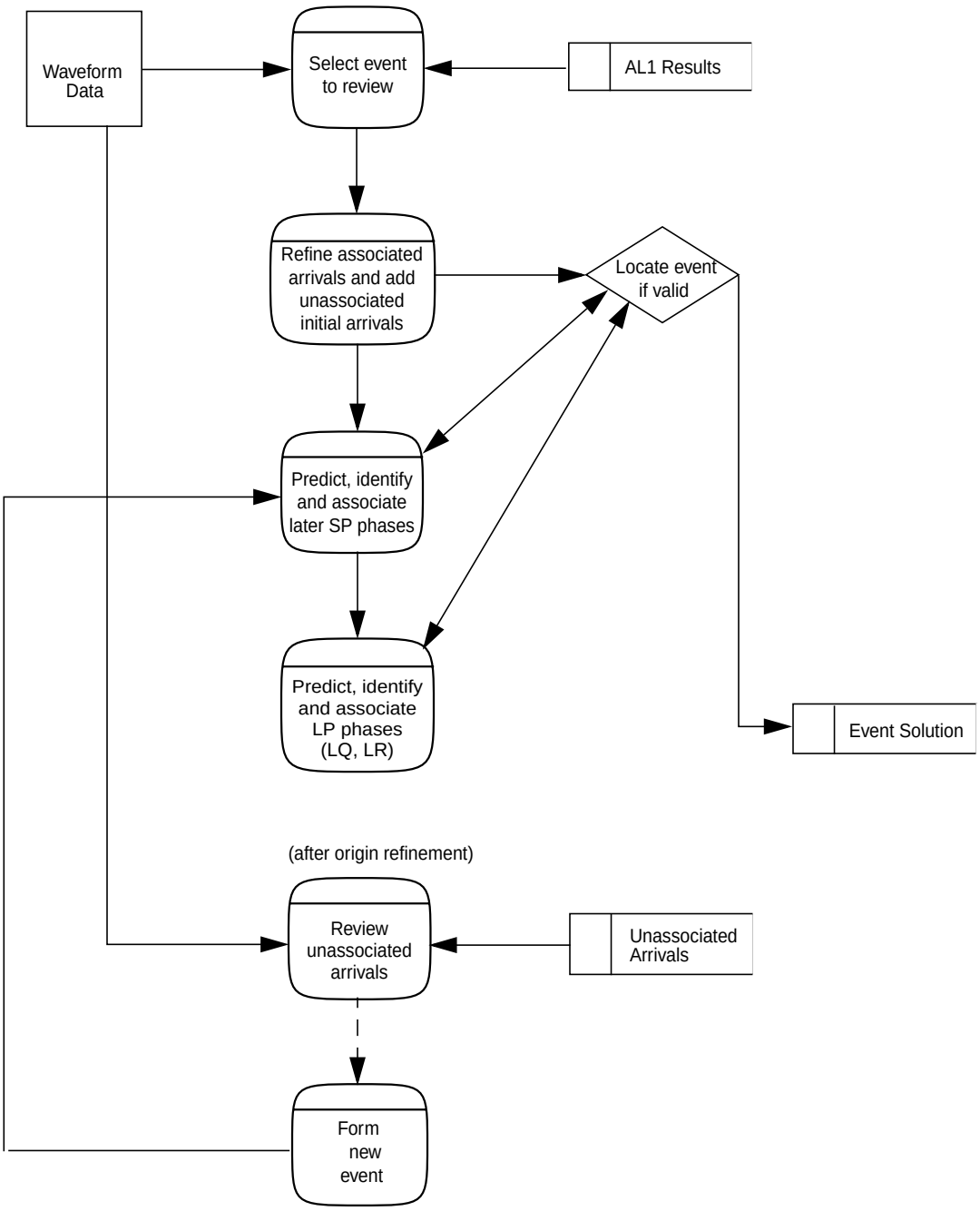

Figure 4-27. SEA2 Analysis Process Flow Diagram

4-216. AUTO-AL2 PROCESSING.

4-217. AUTO-AL2 processing is the sixth stage of the Global pipeline. AUTO-AL2 processing (figure 4-28) prepares the input data for the EEA1 analyst by creating all

necessary beams and measurements based on the results saved by the SEA2 analyst. The processing duplicates the AUTO-AL1 processing, and adds processes to determine the maximum-likelihood bodywave magnitudes for events, to create AFTAC triple locations for events, and to search for hydroacoustic arrivals to associate to the oceanic events.

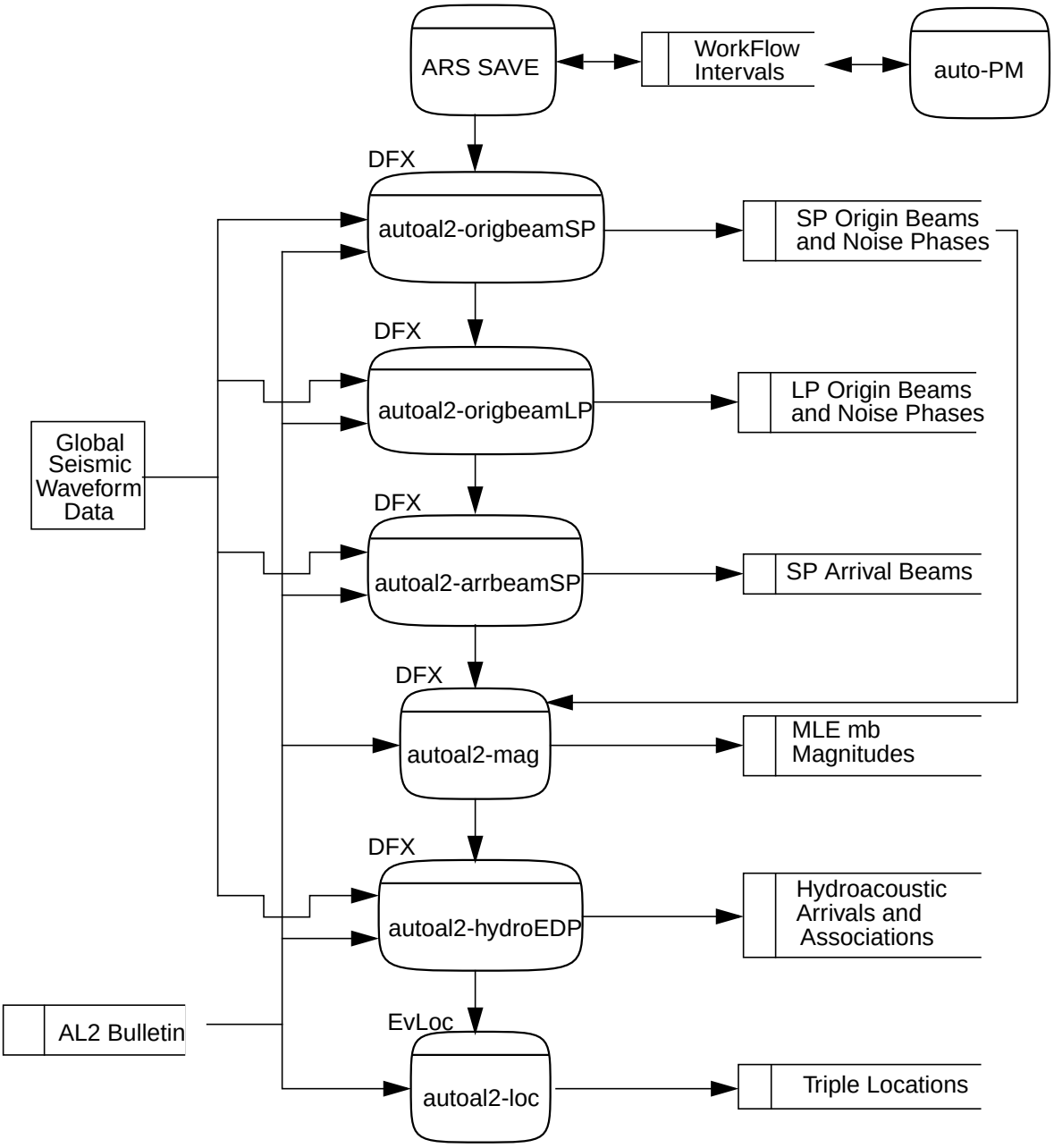

Figure 4-28. AUTO-AL2 Processing Data Flow Diagram

4-218. The autoal2-obeamSP process creates SP origin beams for new events which were formed by the SEA2 analyst and updates any existing origin beams to account for potentially significant differences in beam-steering resulting from changes in event locations. The analyst does not save any origin beams, since they are efficiently created in the post-analysis processing. The processing makes noise P phases and measures the noise amplitude and period at the theoretical time for non-detecting stations in the appropriate distance range. The noise statistics are used to help define the maximum-likelihood body-wave magnitude for an event.

4-219. The autoal2-obeamLP process creates LP origin beams around the predicted arrival times of the LQ and LR surface wave phases for events saved in the al2 account. Vertical and transverse beams are created for analysis of Rayleigh and Love waves, respectively.

4-220. The autoal2-abeamSP process creates arrival beams for arrivals which do not already have beams. The arrival beams are configured to be five minutes long, but when there is not enough data to create a five-minute beam for a given arrival, it will create the beam from whatever waveform data is available. The analyst does not save any arrival beams, since they are efficiently created in the post-analysis processing.

4-221. The autoal2-mag process utilizes noise measurements to compute the maximum-likelihood bodywave magnitudes for events. Incorporating the measurements of noise level at stations which did not report arrivals improves the estimate of the magnitude.

4-222. The autoal2-hydroEDP process identifies hydroacoustic signals produced by earthquakes or other events under the surface of the ocean. Hydroacoustic phases travel comparatively slow, and may arrive at sensors many minutes or hours after the seismic phases have all been received. Thus, an accurate seismic location can sometimes be used to predict hydroacoustic arrivals in advance. For the set of offshore seismic events covered by an ARS al2 interval, the event-driven processing calculates the theoretical arrival times for hydroacoustic phases, then attempts to find hydroacoustic detections based on those predictions. Arrivals meeting appropriate criteria are then associated with the events and written to the AL2 database.

4-223. The autoal2-loc process determines three possible solutions for the event location: surface location, restrained location, and free location. Locations redundant with an analyst-restrained location are not made. For example, if the analyst-restrained location is at the surface, then no surface location is added. The triple-location results may be used as an aid to event classification. The solutions are saved in the evloc_* and af_* tables which are not read/accessed by the interactive processing software.

4-224. EEA1 ANALYSIS.

4-225. EEA1 analysis is the seventh stage of the Global pipeline. EEA1 analysis (figure 4-29) differs from SEA2 analysis primarily in that the EEA1 analyst also classifies the area of interest (AI) event solutions into categories of interest using all available waveform

data sources, including hydroacoustic data. The EEA1 analyst starts with a read of the data into ARS, which creates an ARS eval1 interval. The analyst reviews the events formed by the SEA2 analyst and refines arrival and event data as necessary. When the EEA1 analyst issues the Save Data command, ARS saves the remaining unassociated arrivals to the eval1 account, automatically creates a post-analyst processing AUTO-EVAL1 interval in the global account, and initiates AUTO-EVAL1 processing on the interval. This stage is the first where DoE KB travel-time corrections and/or GIS products may be employed.

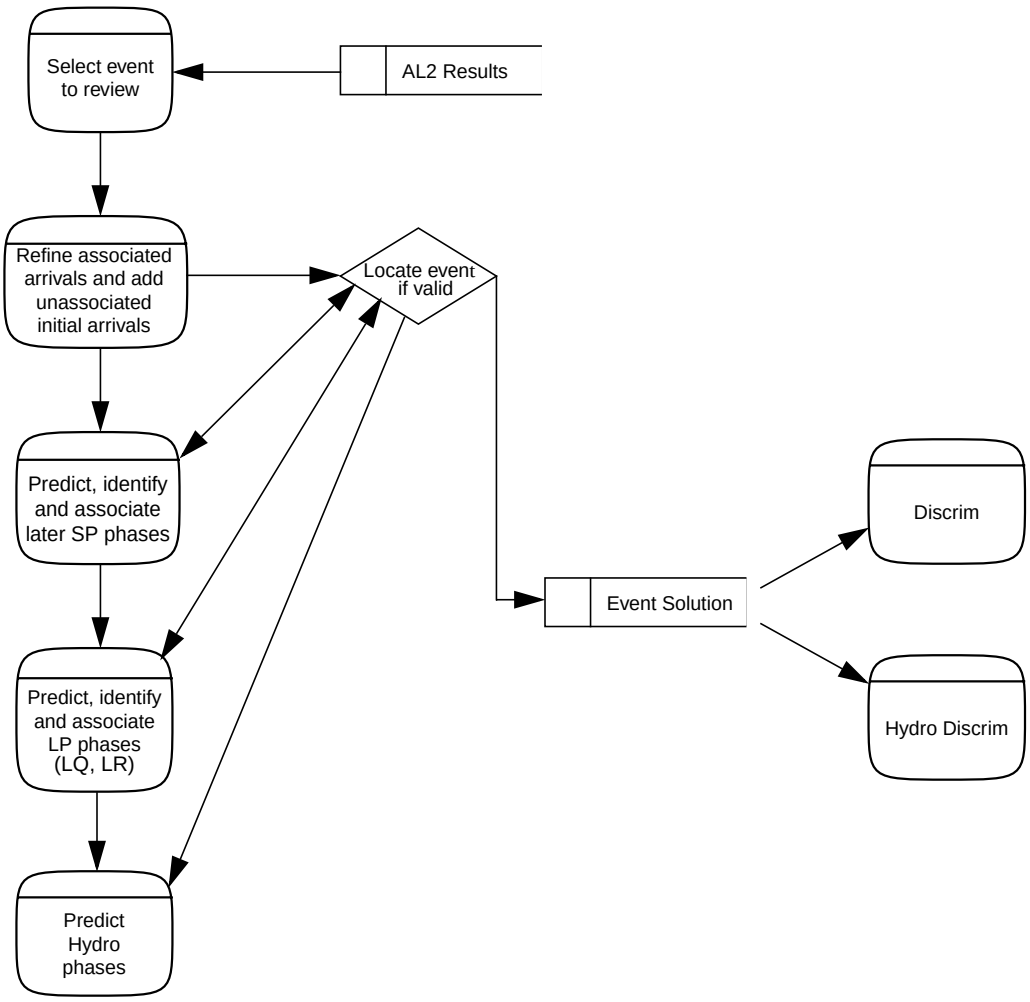

Figure 4-29. EEA1 Analysis Process Flow Diagram

4-226. The input to EEA1 analysis is the SEA2 Bulletin in the al2 database account (accessed through the in_* synonyms in the eval1 account) and any results that were saved in the eval1 account during a previous EEA1 analysis session for the same interval or for the adjacent intervals. Information in the eval1 account regarding a particular event, arrival, etc., takes precedence over the same information found in the al2 account.

4-227. In EEA1 analysis, event solutions are obtained using a multi-stage iterative procedure during which the origins are refined, augmented, and finally classified by:

a. Distinguishing between events in AI and outside areas of interest (OAI).

b. Saving the final event solution as appropriate for the AI or OAI events.

c. Initiating Discrim analysis on AI events.

d. Initiating Hydro-Discrim analysis on oceanic AI events.

4-228. DISCRIM AUTOMATED PROCESSING.

4-229. The Discrim application is an analyst-invoked software tool which is part of EEA1 and EEA2. It requires a specific set of measurements at all available stations for an event, and certain discrimination-specific database tables need to be filled in. Therefore, when an analyst selects the Discrim button in the ARS menu bar, an automated processing pipeline is invoked to prepare all the needed information. See figure 4-30.

4-230. The PM process schedules and controls the following sequence of processes to be run on a saved event. When the sequence is completed, it then starts or updates the Discrim application itself. PM will not rerun processes automatically when a failure is encountered.

4-231. The discrim-origbeamSP process makes SP origin beams and noise measurements from the beams.

4-232. The discrim-classampSP process makes SP classification measurements of several types of amplitude, period, signal, and noise in various time windows from the arrival beam.

4-233. The discrim-origbeamLP process makes SP origin beams and noise measurements from the beams.

4-234. The discrim-origampNL process measures the LP noise level in a window preceding the predicted primary arrival (P or PKPdf) for a station which has no LP phases (LR or LQ) associated. The purpose is to measure a noise level before the event with which the noise amplitude measured at the predicted time for LR can be compared.

4-235. The discrim-msnmag process determines the maximum-likelihood surface-wave noise magnitude (msn) for an event, including noise measurements at stations without surface wave amplitude measurements.

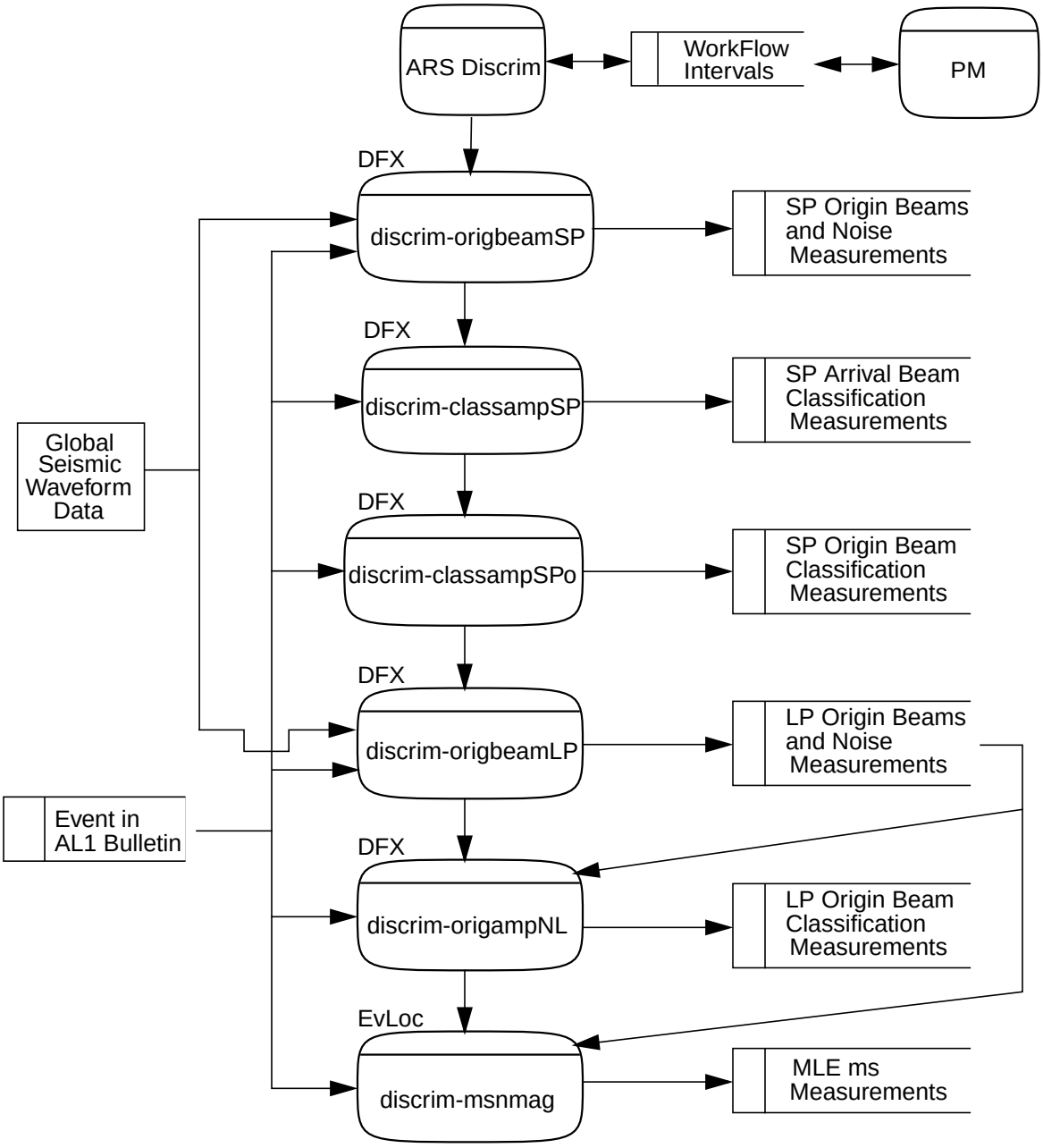

Figure 4-30. Discrim Automated Processing Data Flow Diagram

4-236. DISCRIM ANALYSIS.

4-237. The purpose of Discrim analysis is to verify and, when necessary, modify the individual measurements and final classification votes for seismic observations. Discrim analysis is conducted for AI and noteworthy OAI events. See figure 4-31. The Discrim program itself lies at the end of the Discrim Automated Processing pipeline which creates origin beams and computes the numerous measurements needed for event classification using seismic observations (e.g., the pre-P LP noise measurement made on the LP origin beam). Therefore, it is necessary that arrival onset time adjustments and other event refinements must be completed before initiating this processing.

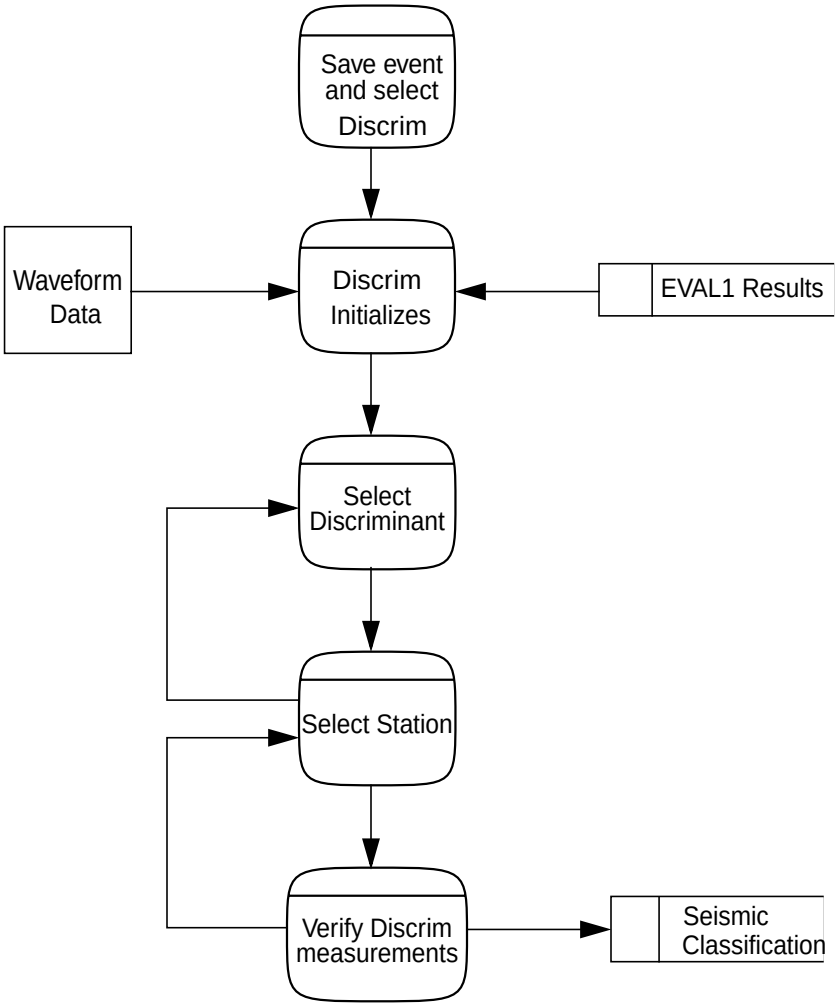

Figure 4-31. Discrim Analysis Process Flow Diagram

4-238. HYDRO-DISCRIM ANALYSIS.

4-239. The purpose of Hydro-Discrim analysis is to verify and, when necessary, modify the individual measurements and final classification votes for hydroacoustic observations. Hydro-Discrim analysis is conducted for oceanic AI and noteworthy OAI events. See figure 4-32. Unlike Discrim, Hydro-Discrim is not preceded by automated processing. The Hydro Display toolbar (HDT) item in ARS merely initiates a process which populates the necessary database tables and invokes the hydrodisplay tool.

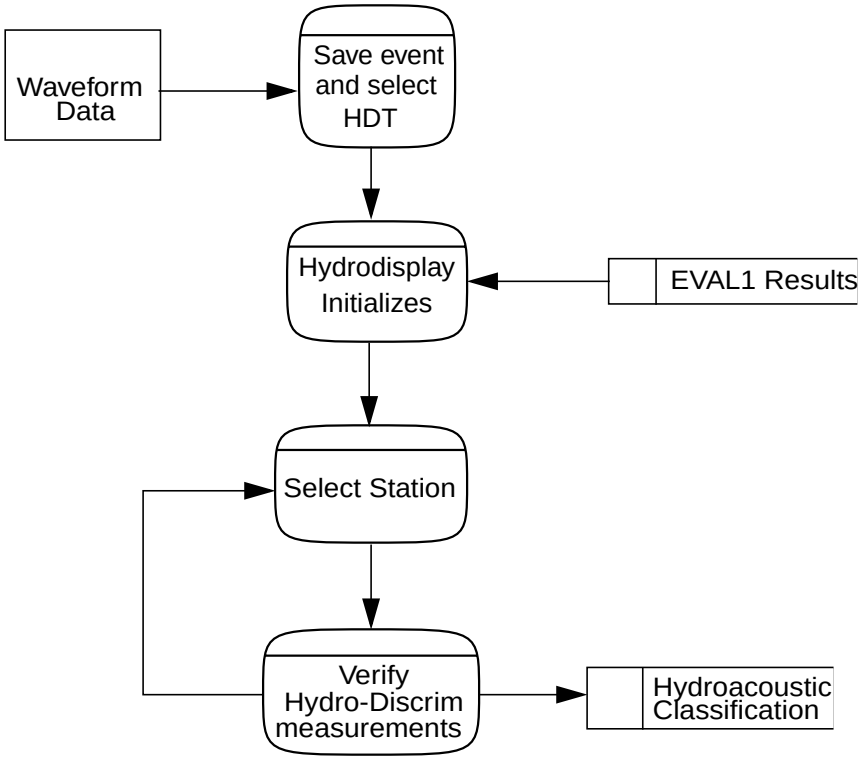

Figure 4-32. Hydro-Discrim Analysis Process Flow Diagram

4-240. AUTO-EVAL1 PROCESSING.

4-241. AUTO-EVAL1 processing is the eighth stage of the Global pipeline. AUTO-EVAL1 processing prepares the input data for the EEA2 analyst by creating SP origin beams and noise measurements for AOI events, determining the maximum-likelihood bodywave magnitudes for events, and creating AFTAC triple locations for events. See figure 4-33.

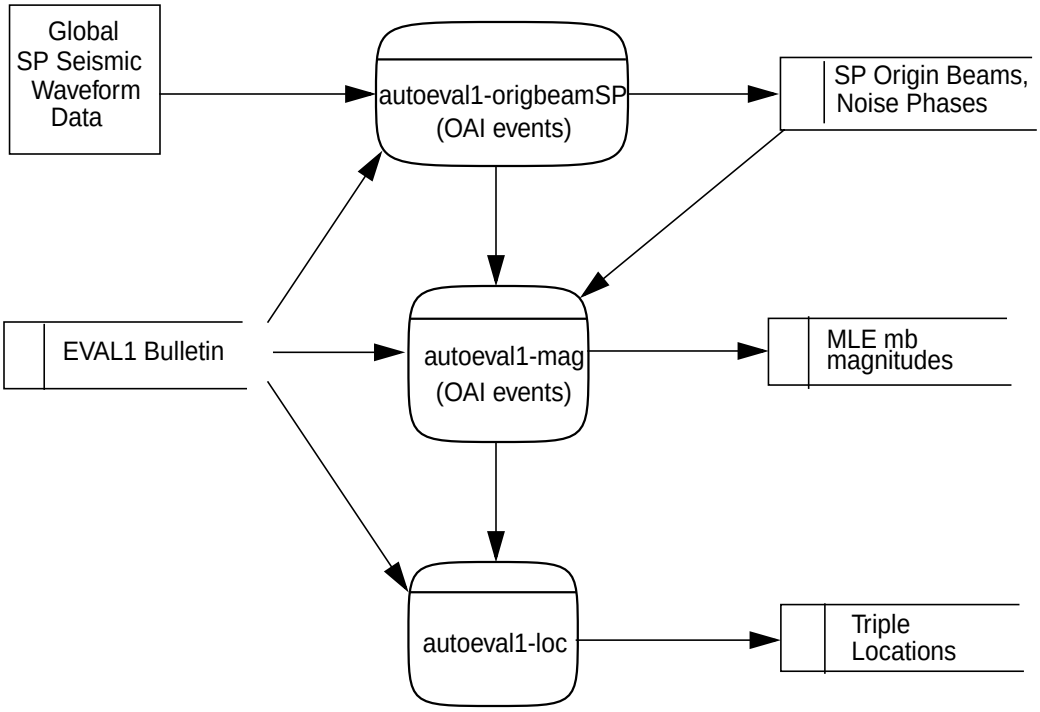

Figure 4-33. AUTO-EVAL1 Processing Data Flow Diagram

4-242. The autoeval1-origbeamSP process creates SP origin beams for new events which were formed by the EEA1 analyst and updates any existing origin beams to account for potentially significant differences in beam-steering resulting from changes in event locations. The analyst does not save any origin beams, since they are efficiently created in the post-analysis processing. The processing makes noise P phases and measures the noise amplitude and period at the theoretical time for non-detecting stations in the appropriate distance range. The noise statistics are used to help define the maximum-likelihood body-wave magnitude for an event.

4-243. The autoal2-mag process utilizes noise measurements to compute the maximum-likelihood bodywave magnitudes for events. Incorporating the measurements of noise level at stations which did not report arrivals improves the estimate of the magnitude.

4-244. The autoal2-loc process determines three possible solutions for the event location: surface location, restrained location, and free location. Locations redundant with an analyst-restrained location are not made. For example, if the analyst-restrained location is at the surface, then no surface location is added. The triple-location results may be used as an aid to event classification. The solutions are saved in the evloc_* and af_* tables which are not read/accessed by the interactive processing software.

4-245. EEA2 ANALYSIS.

4-246. EEA2 analysis is the ninth stage of the Global pipeline. EEA2 analysis differs from EEA1 analysis primarily in that the EEA2 analyst may classify the AI event solutions into categories of interest using all available waveform data sources including hydroacoustic data. See figure 4-34. The EEA2 analyst starts with a read of the data into ARS, which creates an ARS eval2 interval. The analyst reviews the events formed by the EEA1 analyst and refines arrival and event data as necessary. When the SEA2 saves the results, ARS automatically creates a post-analyst processing AUTO-EVAL2 interval and requests it to be processed by the auto-PM process.

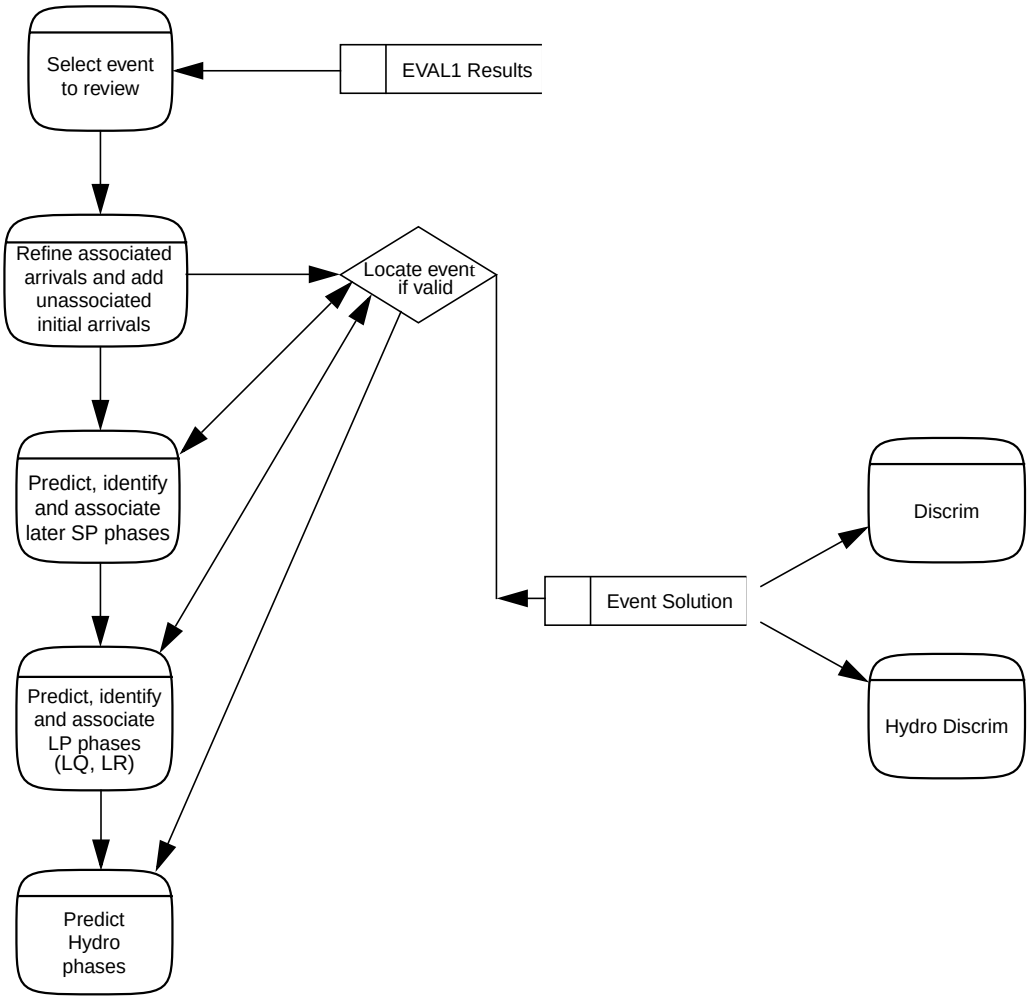

Figure 4-34. EEA2 Analysis Process Flow Diagram

4-247. The input to EEA2 analysis is the EEA1 Bulletin in the eval1 database account (accessed through the in_* synonyms in the eval2 account) and any results saved in the eval2 account during a previous EEA2 analysis session for the same interval or for the adjacent intervals. Information in the eval2 account regarding a particular event, arrival, etc., takes precedence over the same information found in the eval1 account.

4-248. In EEA2 analysis, event solutions are obtained using a multi-stage iterative procedure during which the origins are refined, augmented, and finally classified by:

a. Saving the final event solution.

b. Initiating Discrim analysis on AI events.

c. Initiating Hydro-Discrim analysis on oceanic AI events.

4-249. AUTO-EVAL2 PROCESSING.

4-250. AUTO-EVAL2 processing is the final stage of the Global pipeline. AUTO-EVAL2 processing prepares the input data for the EEA2 analyst by creating SP origin beams and noise measurements for AOI events, determining the maximum-likelihood bodywave magnitudes for events, and creating AFTAC triple locations for events. See figure 4-35.

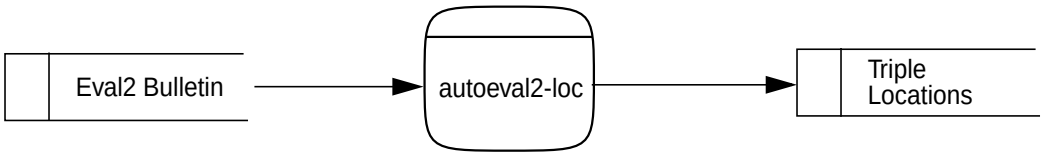

Figure 4-35. AUTO-EVAL2 Processing Data Flow Diagram

4-251. BARM PIPELINE.

4-252. The BARM pipeline transforms raw waveforms into alphanumeric event data through two stages of automated processing and one stage of interactive processing. The analysis stage is followed by a stage of post-analysis processing (AUTO-BARAL1). Events located within a selected broad-area region are formed using a subset of the available seismic stations at regional and teleseismic distances from the region. The purpose of the pipeline is to detect events within the selected region at lower thresholds than those achieved with the Global pipeline. To that end, event definition criteria are relaxed. Figure 36 shows the data flow within the BARM pipeline.

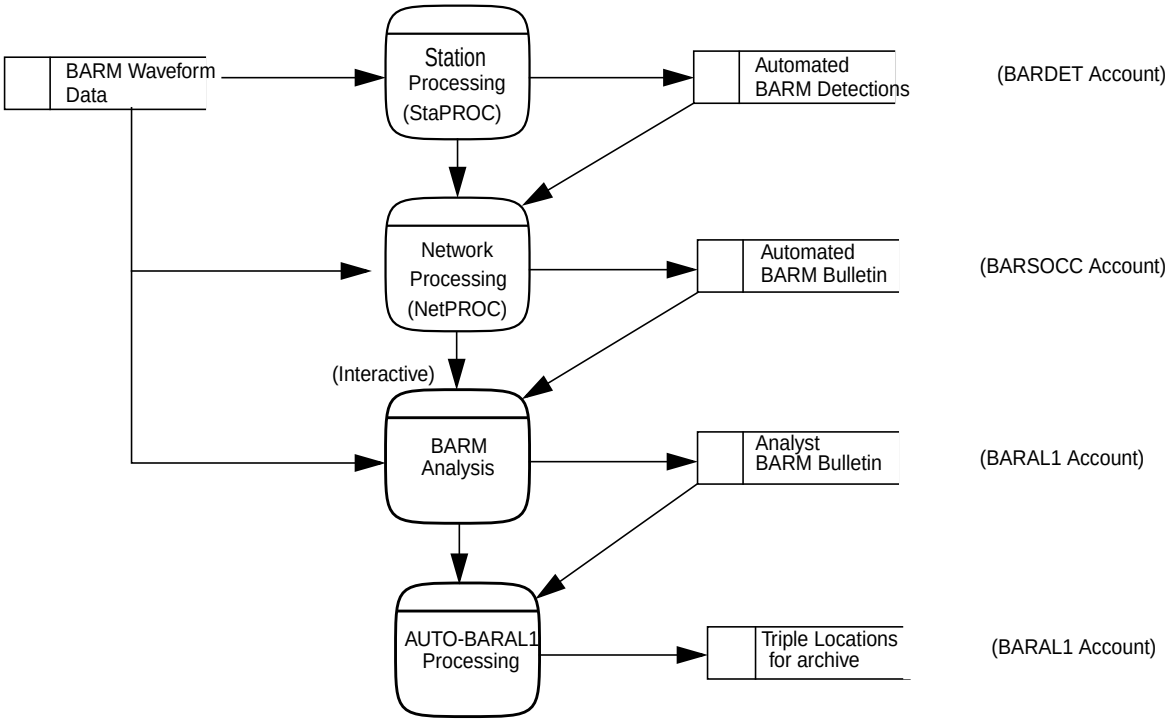

Figure 4-36. BARM Pipeline Data Flow Diagram

4-253. Waveform and alphanumeric data are run through station processing and network processing to detect signals and to form preliminary events, respectively. The resulting automated bulletin is then analyzed by a BARM analyst. The primary goal of a BARM analyst is to review, validate, refine and, when possible, augment the event solutions generated by the automated processing. The interactive stage also provides evaluation capabilities. It includes automated processing which is run after analyst review and before discrimination analysis (Discrim processing).

4-254. BARM STATION PROCESSING.

4-255. BARM station processing (StaPROC) is the first stage of the BARM pipeline. BARM station processing (figure 4-37) runs against BARM seismic station intervals and treats each station in isolation, making detections, measurements, and beams according to the properties of the detections themselves. Network information about events is not available at this stage. BARM station processing accomplishes all the processing that can be done at the station level.

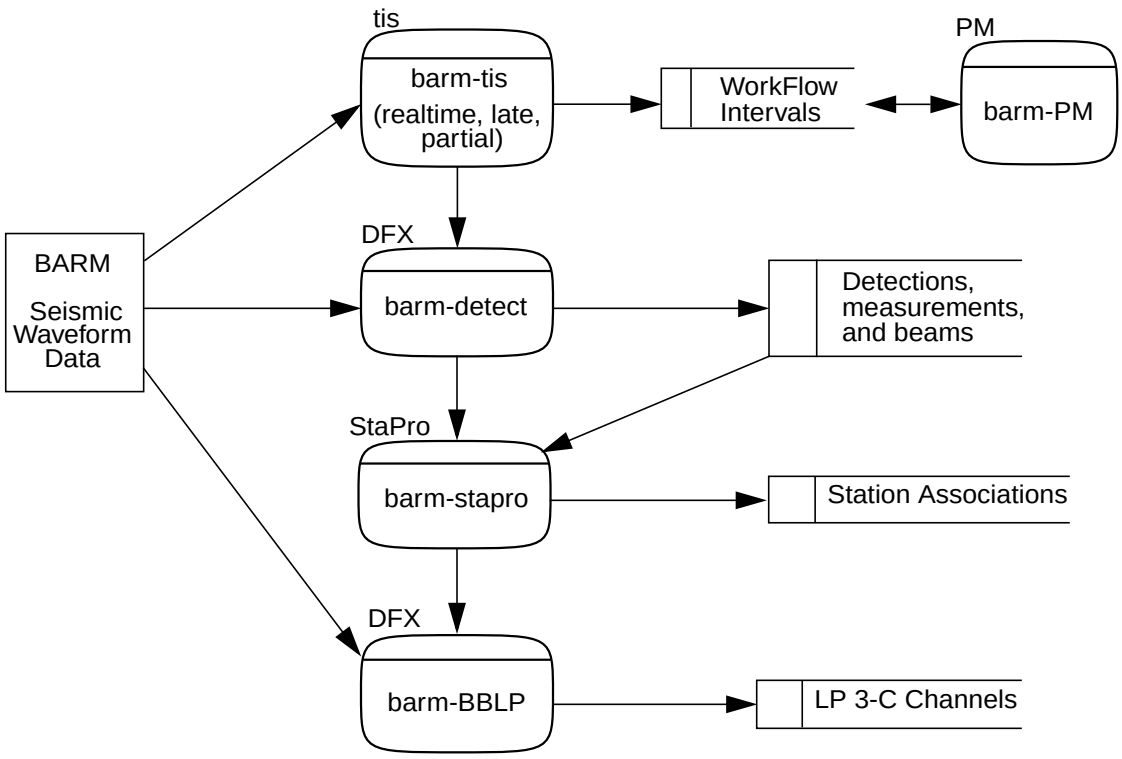

Figure 4-37. BARM Station Processing Data Flow Diagram

4-256. The barm-tis-realtime process monitors the incoming raw data in a candidate time interval of a specified length for a station. It creates a BARM interval with a state of ‘queued’ in the BARM database account and initiates processing on the interval when approximately 100 percent of the interval is covered by at least one station channel. If a candidate interval does not become nearly 100 percent filled, but it is more than 15 percent filled, then barm-tis-realtime creates a ‘partial’ interval. If the candidate interval does not become nearly 15 percent filled, then barm-tis-realtime creates a ‘skipped’ interval.

4-257. When approximately 10 minutes have elapsed since a ‘partial’ interval was created, which gave the DAS a finite amount of time to fill-in the time interval, barm-tis-partial updates the state of the interval to ‘pending’, and barm-tis-realtime initiates processing on the interval. If a ‘skipped’ interval becomes more than 15 percent filled, barm-tis-late updates the state of the interval to ‘pending’ or ‘partial’ as appropriate, and barm-tis-realtime initiates processing on the interval.

4-258. The barm-PM process schedules and controls a sequence of processes to be run on each BARM interval marked ‘queued’ by the barm-tis-realtime process. As the processing is performed, the PM updates the state of the interval to show the current active process in the sequence. When processing is completed, barm-PM sets the state of the interval to ‘station-done’. If one of the processes fails, then barm-PM will attempt.

4-259. The barm-detect process creates arrival records for valid signals detected on seismic stations. These records contain information such as the arrival onset time, signal-to-noise ratio, amplitude, and period. It then attempts to generate an arrival beam around each arrival, to correspond to the feature measurements made on the arrivals. For array stations, the beam is based on the azimuth and slowness determined from the f-k spectrum of the arrival. When there is not enough waveform data to generate the full beam, it is left to the network processing stage of the BARM pipeline to generate the arrival beams.

4-260. The barm-stapro process groups together arrivals for each station that can reasonably be presumed to have a common origin. The grouping together of arrivals is made on the basis of azimuth and slowness for array and three-component sites. This station grouping lessens the likelihood that network association processing will create false multiple events using later arrivals from a single origin.

4-261. The barm-BBLP process applies filters to derive long period (LP) waveforms from broadband (BB) waveforms, for stations that are not processed by the Global pipeline and which do not transmit LP data from the station site. The LP channels are suitable for analysis and interpretation of surface waves (LQ and LR).

4-262. BARM NETWORK PROCESSING.

4-263. BARM network processing (NetPROC) is the second stage of the BARM pipeline. BARM network processing (figure 4-38) starts when enough station data have accumulated to form a network interval (BNET). This involves assembling detection data to produce event locations based on multiple stations.

4-264. The bnetwork-tin process monitors the number of processed station intervals in a candidate time interval of a specified length and creates a BNET interval in the BARM database account when the number reaches the configured threshold. After an initial wait time of 40 minutes, bnetwork-tin creates the interval and initiates processing only when station processing has completed on most of the stations in the network. If not enough station processing has completed, bnetwork-tin drops the threshold and waits an additional 5 minutes before creating and processing the interval. This is repeated until the number of stations processed exceeds the threshold. Eventually, if sufficient data are not received, the threshold drops below a reasonable level for the association of available arrivals, at which point the candidate time interval is skipped.

4-265. The bnetwork-PM process schedules and controls a sequence of processes to be run on each BNET interval marked ‘queued’ by the bnetwork-tin process. As the processing is performed, the PM updates the state of the interval to show the current active process in the sequence. When processing is completed, bnetwork-PM sets the state of the interval to ‘network-done.’ If one of the processes other than the bnetwork-conflict process fails, then bnetwork-PM will attempt to rerun the process. If the process fails a second time, then bnetwork-PM will set the state of the interval to ‘failed’.

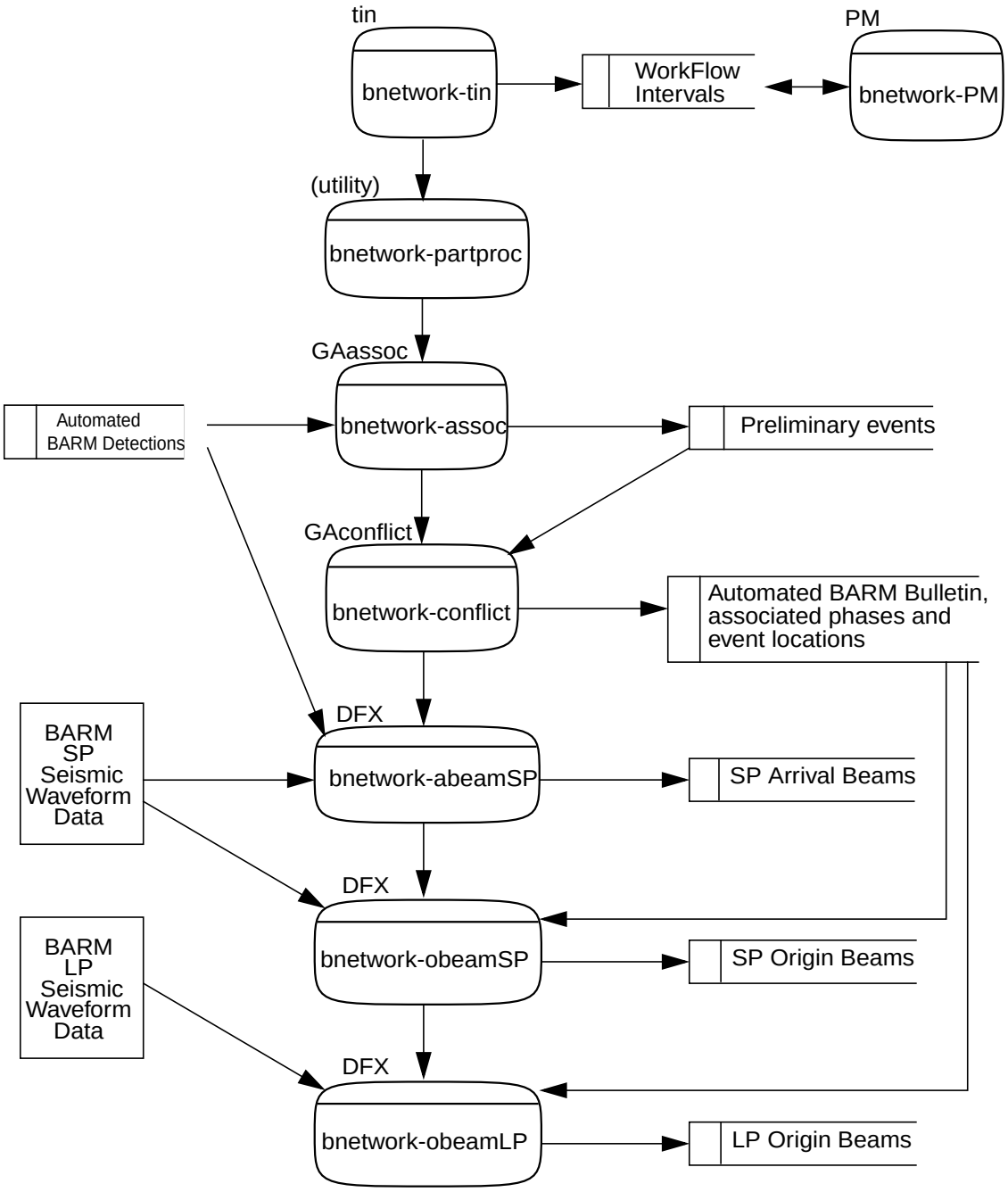

Figure 4-38. BARM Network Processing Data Flow Diagram

4-266. The bnetwork-partproc process initiates station processing on all partial station intervals within the network interval. When the barm-tis-realtime process determines that an interval is less than 100 percent filled, it creates a partial interval. While normally a waiting period elapses before the interval is processed to allow data acquisition additional time to

receive any available data, bnetwork-partproc stops the wait so that station processing proceeds on the partial intervals. Then bnetwork-partproc waits up to 5 minutes for any active station processing within the network interval to complete.

4-267. The bnetwork-assoc (GAassoc) and bnetwork-conflict (GAconflict) processes are collectively known as BARM Association (GA). The network interval processed represents the time period of arrivals to be associated together. A look-back is applied by GA to the start-time of the interval to account for the event origin times of any associated arrivals in the interval. GA produces seismic origins by associating station detections, and then writes the results to the barsocc database account.

4-268. The bnetwork-assoc process associates seismic detections to events and locates the events. It takes the detection data provided by station processing and uses an algorithm to group the detections into events. The output is a preliminary set of event data stored in the working tables origin_ga, origerr_ga, and assoc_ga, for refinement by the bnetwork-conflict process.

4-269. The bnetwork-conflict process resolves conflicts between the set of events contained in the working tables produced by bnetwork-assoc and the set of events found in the output origin, origerr, and assoc tables. Resolutions are made for events that overlap and detections that are associated to the wrong event. While resolving conflicts, it also adds defining phases to events where the detections match parameterized constraints. It then outputs the merged results to the origin, origerr, and assoc database tables. Body-wave network magnitude, mb, is estimated, when applicable. Station magnitudes are written to the stamag database table, while network magnitudes are written to the netmag and origin tables.

4-270. When the bnetwork-assoc process first becomes active, it changes the state of the set of station processing time intervals covered by the network processing time interval from ‘station-done’ to ‘assoc-started’. This shows which station processing intervals were completed in time for incorporation into the event bulletin produced by network processing. When the bnetwork-conflict process completes, it changes the state of the same set of station processing time intervals to ‘network-done.’ Station processing intervals which did not complete in time for network processing will not change the state from ‘station-done’ to ‘network-done’, unless there were no arrivals produced by the processing.

4-271. The bnetwork-abeamSP process creates arrival beams for arrivals that do not already have beams. In station processing, sometimes there may not be enough data to form a beam for a given arrival. The bnetwork-abeamSP process creates arrival beams from whatever waveform data is available. Forming some of the arrival beams during network processing, allows data acquisition additional time to receive any available data, so that potentially a greater percentage of the arrival beams complete.

4-272. The bnetwork-obeamSP process forms SP origin beams for non-detecting stations for the set of events covered by a network interval. The term ‘origin beam’ is used to indicate a beam whose parameters are based upon the location of the defining event, rather than on

the characteristics of an arrival. In the absence of any other information, the origin beam should be optimal for detection of arrivals from that origin. The processing determines the theoretical time for arrivals expected from each event/station pair, for the stations that do not have an initial P detection associated to the event, and then forms the beam from waveform data around the theoretical time. The processing can be configured so that SP origin beams are formed only for events that meet specific criteria.

4-273. The bnetwork-obeamLP process, similar to the bnetwork-obeamSP process, forms LP origin beams for non-detecting stations for the set of events covered by a network interval. The processing creates LP origin beams around the predicted arrival times of the LQ and LR surface wave phases for the origins. Vertical and transverse beams are created for analysis of Rayleigh and Love waves, respectively. The processing can be configured so that LP origin beams are formed only for events that meet specific criteria.

4-274. BARM ANALYSIS.

4-275. BARM analysis is the third stage of the BARM pipeline. The primary goal in BARM analysis (figure 4-39) is to review and refine the event solutions generated by the automated processing system, using all available SP data. When BARM network processing has completed a specified number of intervals, the BARM analyst can begin to process a 2 hour-block. The BARM analyst starts with a read of the data into ARS, which creates an ARS baral1 interval. The analyst reviews the events formed by network processing, and refines arrival and event data as necessary. When the BARM analyst issues the **Save Data** command, ARS saves the remaining unassociated arrivals to the baral1 account.

4-276. The input to BARM analysis is the Automated Bulletin in the barsocc database account (accessed through the in_* synonyms in the baral1 account), and any results that were saved in the baral1 account during a previous BARM analysis session for the same interval or for the adjacent intervals. Information in the baral1 account regarding a particular event, arrival, etc., takes precedence over the same information found in the barsocc account.

4-277. In BARM analysis, event solutions are obtained using a multi-stage iterative procedure during which the origins are refined and augmented by:

a. Locating the event.

b. Adjusting existing detections (e.g., associating, re-timing, renaming).

c. Adding new detections.

d. Making arrivals defining/non-defining for location/magnitude.

e. Relocating the event to include the additional/modified information.

f. Verifying that the additional/modified information is consistent with the event.

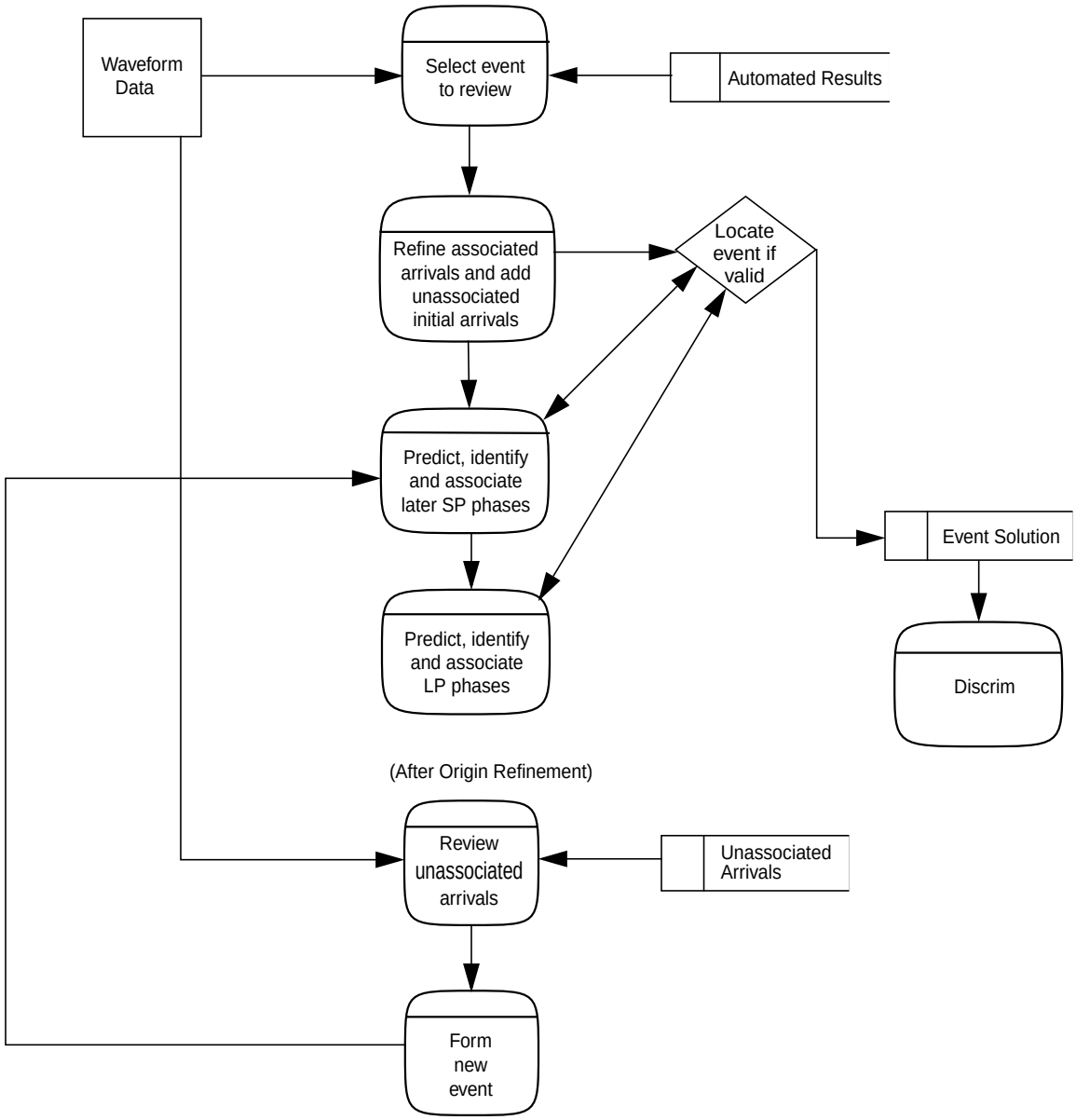

Figure 4-39. BARM Analysis Process Flow Diagram

4-278. BARM analysis also includes the capability to classify events by initiating Discrim analysis for selected events. Discrim automated processing and analysis are described in the Section for the Global Pipeline. This interactive stage is followed by a post-analysis automated processing stage, AUTO-BARAL1, described in figure 4-40. The purpose of this last stage is to calculate triple locations and to populate the AFTAC extension tables for archiving.

Figure 4-40. AUTO-BARAL1 Processing Data Flow

4-279. SPOTLIGHT PIPELINE.

4-280. The Spotlight pipeline transforms raw waveform data into alphanumeric event data in one stage of automated and interactive data processing, respectively. The purpose of the Spotlight pipeline is to allow for continuous monitoring of an area of special concern using lower thresholds (e.g., relaxed event formation criteria). Waveform and alphanumeric data is run through the first stage of the pipeline to detect signals and to form preliminary events in automated processing, referred to as station processing. Unlike the processing conducted for the Global pipeline, there is only one interactive analysis stage for Spotlight analysis. The primary goal for the Spotlight analyst is to review, refine, and when possible, augment the event solutions generated by the automated processing.

4-281. SPOTLIGHT STATION PROCESSING.

4-282. Spotlight station processing is the first stage of the Spotlight pipeline. Spotlight station processing runs against spotlight seismic station intervals (SPOT) and treats each seismic station in isolation making detections, measurements, and beams according to the properties of the detections themselves. See figure 4-41. In other words, information based on the network about events is not yet available at this stage. Spotlight station processing accomplishes all the processing which can be done at the station level.

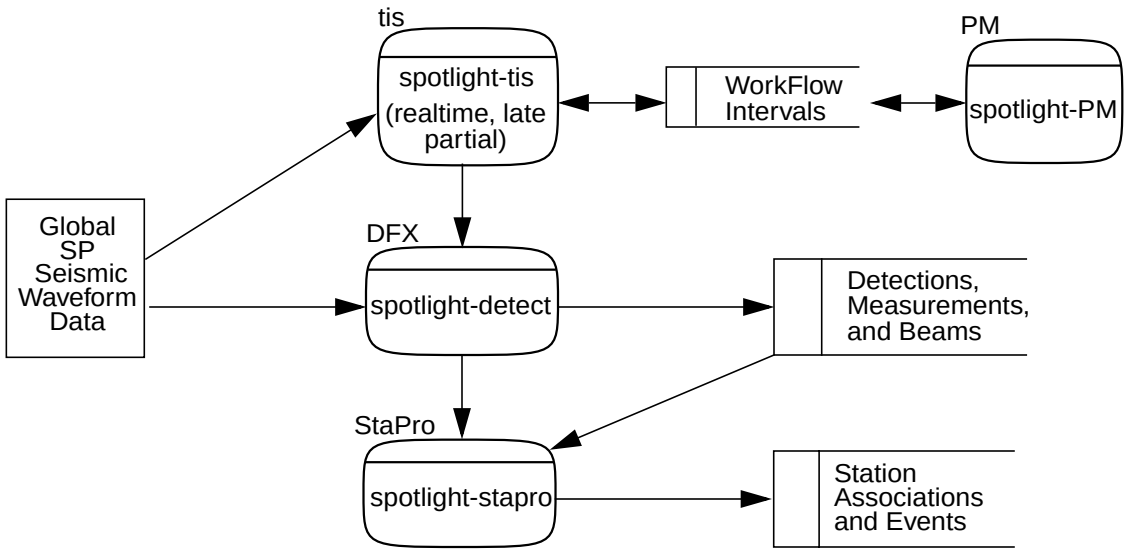

Figure 4-41. Spotlight Station Processing Data Flow Diagram

4-283. The spotlight-tis-realtime process monitors the incoming raw data in a candidate 15-minute time interval for a station. It creates a SPOT interval with a state of queued in the global database account and initiates processing on the interval when approximately 100 percent of the interval is covered by at least one station channel. If a candidate interval does not become filled to a parameter-determined percentage, but is more than 15 percent filled, then spotlight-tis-realtime creates a partial interval. If the candidate interval does not become at least 15 percent filled, then spotlight-tis-realtime creates a skipped interval.

4-284. When approximately 10 minutes have elapsed since a partial interval was created, which gives the Data Acquisition Subsystem sufficient time to fill in the time interval, spotlight-tis-partial updates the state of the interval to pending, and spotlight-tis-realtime initiates processing on the interval. If a skipped interval becomes more than 15 percent filled, spotlight-tis-late updates the state of the interval to pending or partial, as appropriate, and spotlight-tis-realtime initiates processing on the interval.

4-285. The spotlight-PM process schedules and controls the following sequence of processes to be run on each SPOT interval marked queued by the spotlight-tis-realtime process. As the processing is performed, the PM updates the state of the interval to show the current active process in the sequence. When processing is complete, spotlight-PM sets the state of the interval to station-done. If one of the processes fails, then spotlight-PM will attempt to rerun the process. If the process fails a second time, then spotlight-PM will set the state of the interval to failed.

4-286. The spotlight-detect process creates arrival records for valid signals detected on seismic stations. These records contain information such as the arrival onset time, SNR,

amplitude, and period. It then generates an arrival beam (fk beam) around each arrival, from the available data, to correspond to the feature measurements made on the arrivals.

4-287. The spotlight-stapro process groups together arrivals for each station which can reasonably be presumed to have a common origin and creates an event (origin) from the association. The grouping together of arrivals is made on the basis of azimuth and slowness for array and three-component sites as well as on the basis of time of arrival for single-component stations.

4-288. SPOTLIGHT ANALYSIS.

4-289. Spotlight analysis is the final stage of the Spotlight pipeline. The primary goal in Spotlight analysis is to review and refine the event solutions generated by the automated processing system using all available SP data. See figure 4-42. When Spotlight station processing has completed eight 15-minute intervals, the analyst can begin to process the two-hour block covering the intervals. The analyst starts with a read of the data into ARS, which creates an ARS ral interval. The analyst reviews the events formed by the Spotlight station processing and refines arrival and event data as necessary. When the analyst issues the Save Data command, ARS saves the remaining unassociated arrivals to the ral account.

4-290. The input to Spotlight analysis is the Automated Bulletin in the regdet database account (accessed through the in_* synonyms in the ral account) and any results which were saved in the ral account during a previous Spotlight analysis session for the same interval or for the adjacent intervals. Information in the ral account regarding a particular event, arrival, etc., takes precedence over the same information found in the regdet account.

4-291. In Spotlight analysis, event solutions are obtained using a multi-stage iterative procedure during which the origins are refined and augmented by:

a. Locating the event.

b. Adjusting existing detections (e.g., associate, re-time, rename).

c. Adding new detections.

d. Relocating the event to include the additional/modified information.

e. Verifying the additional/modified information is consistent with the event.

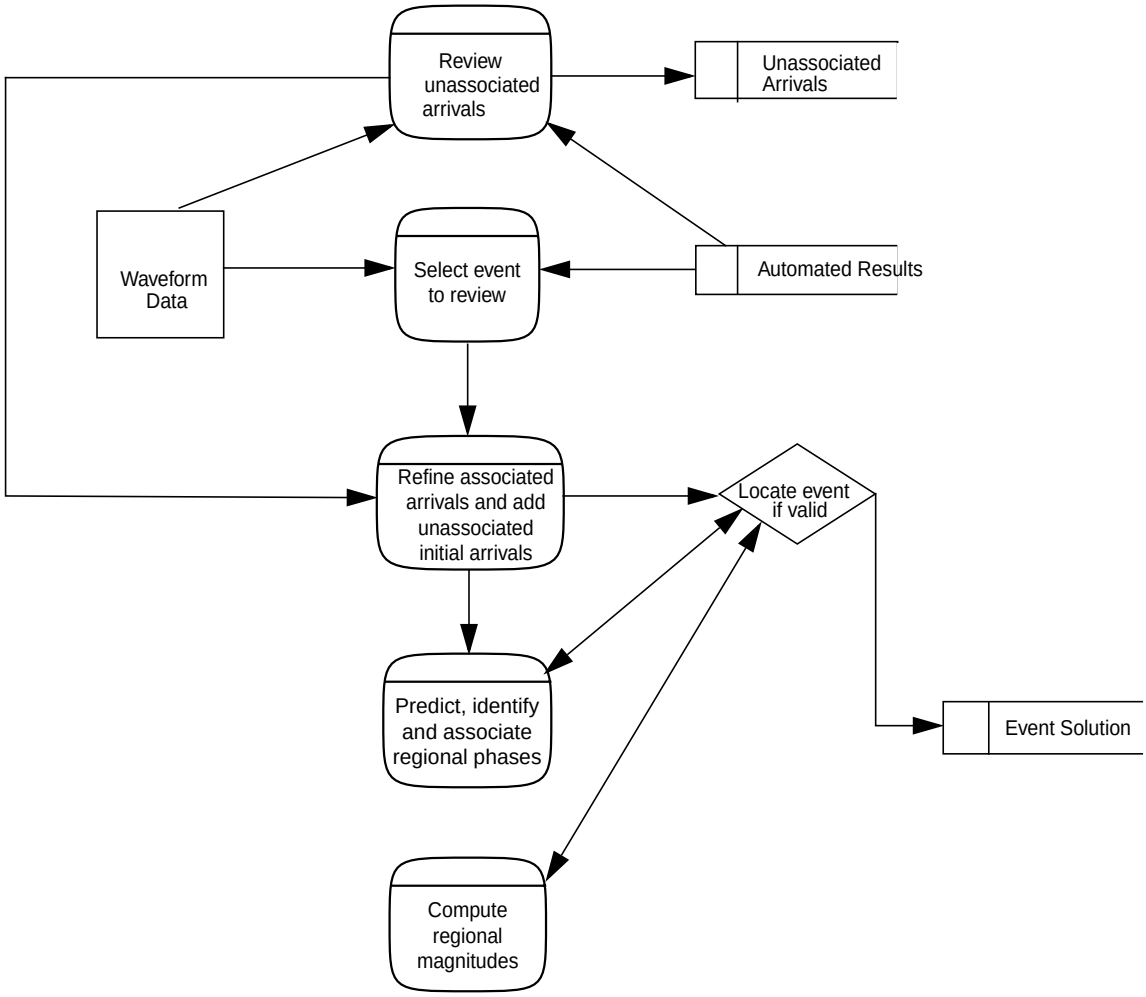

Figure 4-42. Spotlight Analysis Process Flow Diagram

4-292. LOOK-FORWARD PIPELINE.

4-293. The Look-Forward pipeline transforms raw waveform data into alphanumeric event data in two stages of automated processing and one stage of interactive processing. The purpose of the Look-Forward pipeline is to provide accelerated detection of anticipated events in specified target areas.

4-294. Waveform and alphanumeric data is run through the first two stages of the pipeline to detect signals and to form preliminary events in automated processing, referred to as station and network processing, respectively. The resulting automated bulletin is then analyzed. Look-Forward analysis differs from other pipelines in that the trial solutions presented to the analyst are not origins defined by a set of arrivals, but instead a set of arrivals which are consistent with an origin in the target region. Look-Forward analysis also

differs from the global pipeline because the automated processing is performed on a subnetwork of stations. The primary goal for the Look-Forward analyst is to determine whether or not the associated detections provided by the automated system define an event which falls within the area of interest, thus, warrants further attention. If the event is validated, the analyst uses stations from the entire global network to refine the solution.

4-295. LOOK-FORWARD STATION PROCESSING.

4-296. Look-Forward station processing is the first stage of the Look-Forward pipeline. Look-Forward station processing runs against SEIS and treats each seismic station in isolation, making detections, measurements, and beams according to the properties of the detections themselves. See figure 4-43. In other words, information based on the network about events is not yet available at this stage. Look-Forward station processing accomplishes all processing which can be done at the station level.

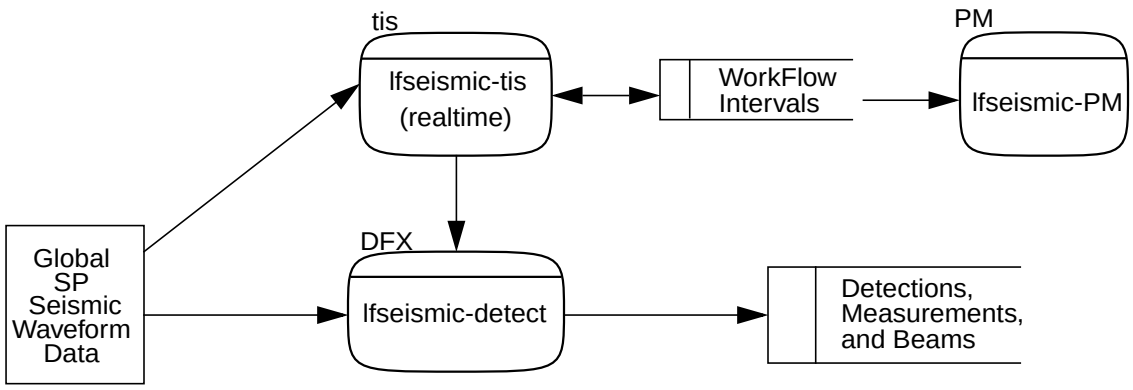

Figure 4-43. Look-Forward Station Processing Data Flow Diagram

4-297. The lfseismic-tis process monitors the incoming raw data in a candidate 15-minute time interval for a station. It creates an LFSEIS interval with a state of queued in the global database account, and initiates processing on the interval when approximately 80 percent of the interval is covered by at least one station channel. If the candidate interval does not become 80 percent filled, lfseismic-tis creates a skipped interval.

4-298. The lfseismic-detect process creates arrival records for valid signals detected out of a set of predefined detection beams for the station. It then attempts to generate five-minute arrival beams (fk beams) around each arrival, to correspond to the feature measurements made on the arrivals. When there is not enough waveform data to generate a full five-minute beam, the network processing stage of the global pipeline will generate the arrival beams. For ASN stations, detection processing will normally run against the BB waveform data for

the station. If there are no BB data for an ASN station interval, the detection processing will run against the available SP data instead.

4-299. LOOK-FORWARD NETWORK PROCESSING.

4-300. Look-Forward network processing is the second stage of the Look-Forward pipeline. Look-Forward network processing starts every five minutes and runs against the dataset whose endtime is given by the current Look-Forward network interval (LFNET). See figure 4-44. This processing assembles the detection data from the available stations to produce event locations based on multiple stations.

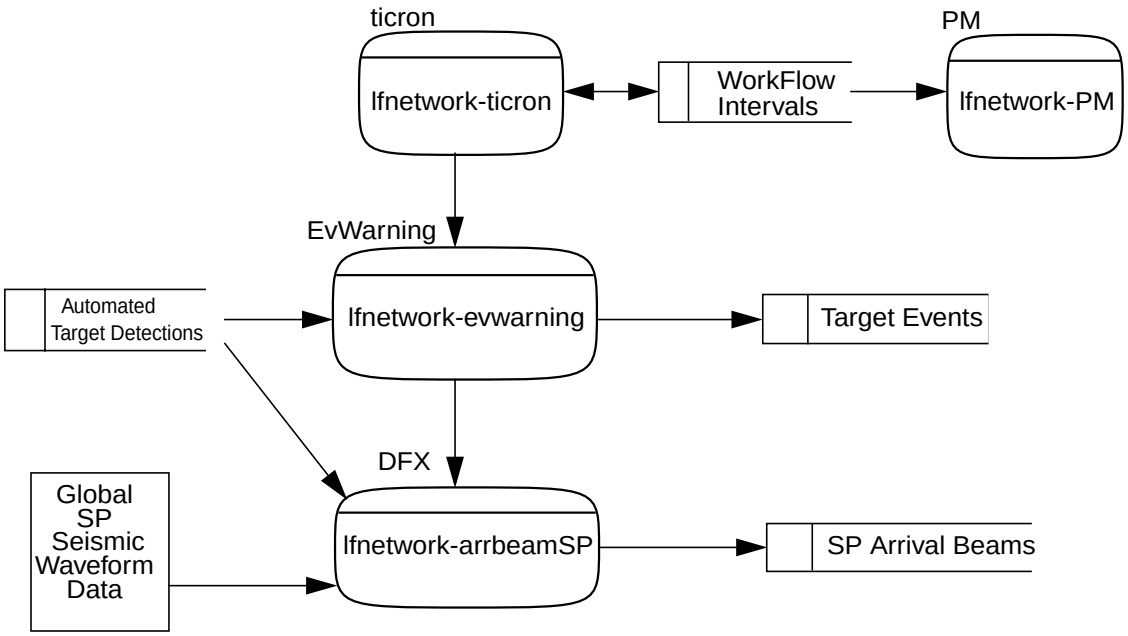

Figure 4-44. Look-Forward Network Processing Data Flow Diagram

4-301. The lfnetwork-ticron process continuously creates LFNET intervals with a state of queued in the global database account and initiates processing on the intervals. No criteria are used when creating the intervals.

4-302. The lfnetwork-evwarning process finds arrival associations by comparing new arrivals with pre-defined information for theoretical arrivals from the target. Origins are created when the number of associated arrivals exceeds the minimum number of associated arrivals defined for the target. Email and an audible alarm are sent to the users specified in the file `/home/ops/.forward` when such an event is evident and accelerated analysis may be performed.

4-303. The lfnetwork-arrbeamSP process creates arrival beams for arrivals which do not already have beams. In station processing, arrival beams are configured to be five minutes long, and sometimes there may not be enough data to form a beam for a given arrival. The network-arrbeamSP process relaxes the five-minute requirement and creates arrival beams from whatever waveform data is available. Forming some of the arrival beams during network processing allows data acquisition additional time to receive any available data, so potentially a greater percent of the arrival beams will be five minutes long.

4-304. LOOK-FORWARD ANALYSIS.

4-305. Look-Forward analysis is the final stage of the Look-Forward pipeline. The primary goal in Look-Forward analysis is to determine if the associated arrivals provided by the automated processing system define a valid event close enough to the original target area to warrant further consideration and analysis. See figure 4-45. The analyst starts by reading data into ARS, which creates an ARS fal interval. The analyst reviews the events formed by network processing and refines arrival and event data as necessary. The Save Data command causes ARS to save the remaining unassociated arrivals to the fal account.

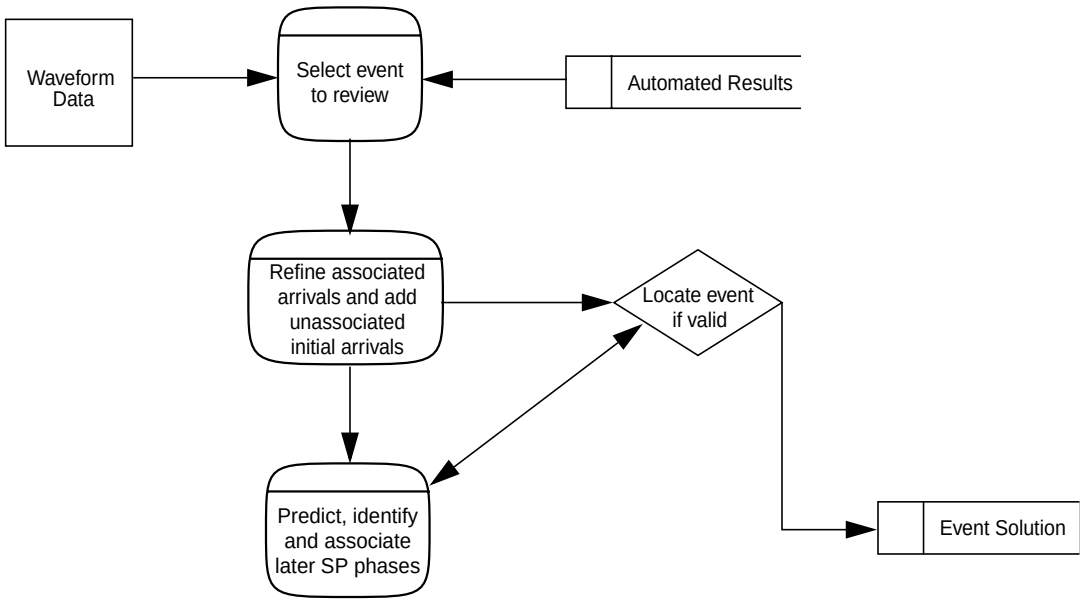

Figure 4-45. Look-Forward Analysis Process Flow Diagram

4-306. The input to Look-Forward pipeline is the Automated Bulletin in the lfdet database account and any results saved in the fal account during a previous Look-Forward analysis session for the same interval or for the adjacent intervals. Information in the fal account regarding a particular event, arrival, etc., takes precedence over the same information found in the lfdet account.

4-307. In Look-Forward analysis, event solutions are obtained using a multi-stage iterative procedure to refine and augment origins:

a. Locating the event. The automated system provides a solution with the target as the origin epicenter and associated arrivals consistent with an event at the target.

b. Locating the event. The automated system provides a solution with the target as the origin epicenter and associated arrivals consistent with an event at the target.

c. Adding new detections.

d. Relocating the event to include the additional/modified information.

e. Verifying the additional/modified information is consistent with the event.

4-308. HYDROACOUSTIC PIPELINE.

4-309. The Hydroacoustic pipeline transforms raw waveform data into alphanumeric event data in one stage of automated processing and one stage of interactive processing.

4-310. HYDROACOUSTIC STATION PROCESSING.

4-311. Hydroacoustic station processing is the first stage of the Hydroacoustic pipeline. Hydroacoustic station processing runs against hydroacoustic station intervals (HYDR) and treats each station in isolation, making detections and measurements. See figure 4-46. Hydroacoustic station processing accomplishes all the processing which can be done at the station level.

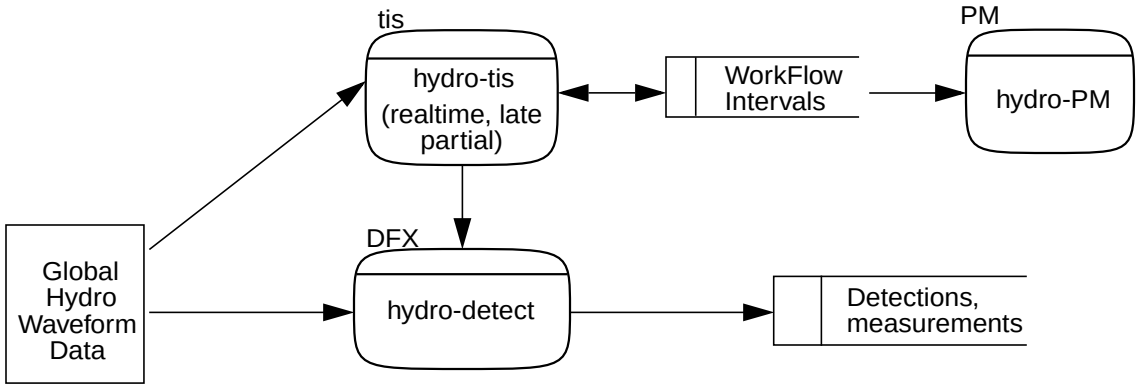

Figure 4-46. Hydroacoustic Station Processing Data Flow Diagram

4-312. The hydro-detect process creates arrival records for valid signals detected on the station, using a high SNR threshold. There is no beamforming with hydroacoustic processing.

4-313. HYDROACOUSTIC ANALYSIS.

4-314. Hydroacoustic analysis (HAL) works with arrivals produced by the automated processing. The automated system does not attempt to associate phases (across the hydroacoustic network) and define origin hypotheses. HAL is performed to review the detections from automated processing, refine the feature measurements for valid signals, modify their phase identification as required, and add signals missed by the automated processing. See figure 4-47.

4-315. The input to HAL is the Automated Bulletin in the hydrodet database account and any results which were saved in the hal account during a previous HAL session for the same interval or for the adjacent intervals. Information in the hal account regarding a particular event, arrival, etc., takes precedence over the same information found in the lfdet account.

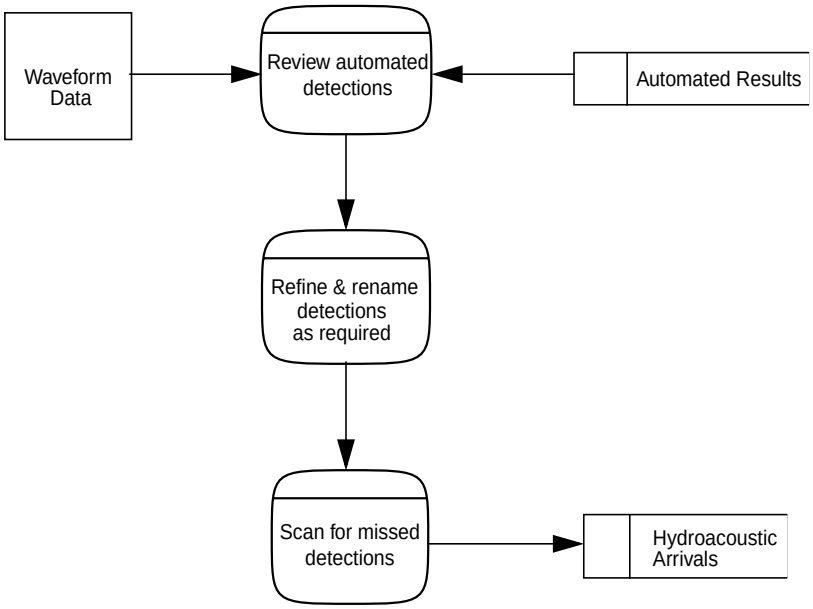

Figure 4-47. Hydroacoustic Analysis Process Flow Diagram

CHAPTER 5

FAULT VERIFICATION

5-1. INTRODUCTION.

5-2. Chapter 5 contains troubleshooting procedures to enable the operator to identify and isolate operational problems, and provides the operator with corrective action procedures.

5-3. GENERAL.

5-4. The operator is responsible for identifying the initial problem and performing corrective actions in accordance with the procedures identified in table 5-1. These procedures are within the scope of the operator's capabilities. If the corrective action is beyond the scope of the operator's capabilities or is not identified in table 5-1, the operator should report the problem to appropriate maintenance personnel to perform further troubleshooting.

5-5. TROUBLESHOOTING.

5-6. The first column of Table 5-1 lists possible problems which may occur during operation, the second column lists the possible source(s) of the problem, and the third column provides a reference to an appropriate troubleshooting procedure.

Table 5-1. Troubleshooting

PROBLEM/SYMPTOM	POSSIBLE SOURCE OF PROBLEM	TROUBLESHOOTING REFERENCE
General System Problems		
A machine shows red in Launch window.	Sockd process is not running.	Refer to paragraph 5-8.
A process shows red (stopped) in Launch window.	Process is not running.	Refer to paragraph 5-10.
Process cannot be started from Launch window.	User does not belong to the ops group.	Report problem to maintenance personnel.
Unclassified Data Acquisition Problems		
A single station outage.	Multiple causes.	Report problem to maintenance personnel.
A single station with sporadic data.		

Table 5-1. Troubleshooting (Cont)

PROBLEM/SYMPTOM	POSSIBLE SOURCE OF PROBLEM	TROUBLESHOOTING REFERENCE
Unclassified Data Acquisition Problems (cont)		
Multiple stations with sporadic data.	Multiple causes.	Report problem to maintenance personnel.
All stations have stopped acquiring.		
The IDC intervals in the DA WorkFlow are missing or behind real-time by more than three hours.	Multiple causes.	Report problem to maintenance personnel.
ArchiveLongTerm sent email saying it has failed to archive an interval. or An interval in Archive WorkFlow is red and has a state of archlong-failed.	A database or file system error.	Report problem to maintenance personnel.
ArchivePermanent sent email saying it has failed to archive an interval. or An interval in Archive WorkFlow is red and has a state of arch-perm-failed.	A database or file system error.	Report problem to maintenance personnel.
The most recent intervals in Archive WorkFlow are missing or blue more than four hours behind real-time.	Multiple causes.	Report problem to maintenance personnel.
Classified Data Acquisition Problems		
A single station outage	Multiple causes.	Report problem to maintenance personnel.
A station with sporadic data		
All stations have stopped acquiring data.		
All unclassified stations have stopped acquiring data.		

Table 5-1. Troubleshooting (Cont)

PROBLEM/SYMPTOM	POSSIBLE SOURCE OF PROBLEM	TROUBLESHOOTING REFERENCE
Classified Data Acquisition Problems (cont)		
ArchiveLongTerm sent email saying it has failed to archive an interval. or An interval in Archive WorkFlow is red and has a state of archlong-failed.	A database or filesystem error.	Report problem to maintenance personnel.
ArchivePermanent sent email saying it has failed to archive an interval. or An interval in Archive WorkFlow is red and has a state of arch-perm-failed.	A database or file system error.	Report problem to maintenance personnel.
The most recent intervals in Archive WorkFlow are missing or blue more than four hours behind real-time.	Multiple causes.	Report problem to maintenance personnel.
Pipeline Problems		
A process shows red (failed) in Pipeline Launch.	Detect or assoc processing has been idle.	Refer to paragraph 5-13.
	Log directory is missing.	Report problem to maintenance personnel.
	General system failure.	
A station processing interval (LFSEIS, SEIS, HYDR, SPOT, BARM) shows red (failed) in Pipeline WorkFlow.	Station data is incomplete or low quality.	Refer to paragraph 5-15.
	General system failure or processing configuration error.	Report problem to maintenance personnel.
A post-analyst processing interval (AUTO) shows red (failed) in Pipeline WorkFlow.	Abnormal data saved in analyst interval.	Report problem to maintenance personnel.
	General system failure or processing configuration error.	

Table 5-1. Troubleshooting (Cont)

PROBLEM/SYMPTOM	POSSIBLE SOURCE OF PROBLEM	TROUBLESHOOTING REFERENCE
Pipeline Problems (cont)		
An interval has been in an active processing state (queued, <process>-start) for too long in Pipeline WorkFlow.	An isolated inter-process communications error occurred.	Refer to paragraph 5-17.
	The PM process is hung.	
	Dman is hung or all inter-process communications are failing.	Refer to paragraph 5-19.
No new intervals are being created for a station processing interval class (LFSEIS, SEIS, HYDR, SPOT, BARM) in Pipeline WorkFlow.	The CDAS is not receiving new station data.	Refer to the Classified Data Acquisition Problems.
	Tis-realtime process is hung or running slow.	Report the problem to maintenance personnel.
Station intervals covered by a network interval are not in the network-done state in Pipeline WorkFlow.	Station data was late for network processing.	Refer to paragraph 5-21.
ARS has had a busy cursor for too long.	ARS is hung with a bad command sequence.	Refer to paragraph 5-23.
It is taking too long for an event to appear in Discrim.	The evaluator pipeline is failing.	Refer to paragraph 5-25.

5-7. GENERAL SYSTEM PROBLEMS.

5-8. SOCKD IS NOT RUNNING.

5-9. To determine if a Launchd sockd is running, perform the following:

a. Attempt to start the Launchd sockd. In the Launch window, right-click on the red machine box and select the **Start Launchd** menu item.

b. If the red machine box in the Launch window does not turn green (this may take a minute) report the problem to maintenance personnel.

5-10. PROCESS IS NOT RUNNING.

5-11. If a process shows red (stopped) in the Launch window, perform the following:

a. Right-click on the stopped process box, and select **Start** from the menu.

b. If the process does not start, continue troubleshooting IAW Table 5-1.

c. If the process starts but dies each time started, report the problem to maintenance personnel.

5-12. PIPELINE PROBLEMS.

5-13. DETECT OR ASSOC PROCESSING HAS BEEN IDLE.

5-14. One detect or assoc process in each processing pipeline is configured to indicate a failure condition when the pipeline is idle for more than a configured amount of time. To determine if a detect or assoc process failed because it has timed out:

a. Select **Monitor** from the menu of the process in the Pipeline Launch.

b. If the output shows a message like `Timed out after <> seconds`, examine the Pipeline WorkFlow to determine if there are intervals in an active processing state (queued, <process>-start) for this pipeline.

(1) If there are, then refer to the pipeline problem An interval has been in an active processing state... in table 5-1.

(2) If there are not, refer to the pipeline problem No new intervals are being created... in table 5-1.

5-15. STATION DATA IS INCOMPLETE OR LOW QUALITY.

5-16. Station processing intervals sometimes fail because there is incomplete waveform data for the time interval. To determine if an attempt to manually process the interval should be made, perform the following:

a. If the interval is a SEIS interval, select **Monitor filterBBLP** from the interval menu.

(1) If there is no output, refer to paragraph b.

(2) If there is output and it shows a message like `No wfdiscs found`, then the interval likely contains mostly short period data and little or no broadband data. Since it is unlikely that any additional broadband data will be received for the interval, select **Edit Interval** from the interval menu and update the state of the interval to station-done, and skip the following.

(3) If there is output, but it does not show a message like `No wfdiscs found`, then report the problem to maintenance personnel, and skip the following.

b. If the interval is a SEIS, HYDR, SPOT, or BARM interval, select **Monitor stapro** from the interval menu.

(1) If there is no output, refer to paragraph c.

(2) If there is output, report the problem to maintenance personnel, and skip the following.

c. Select **Monitor detect** from the interval menu.

(1) If there is no output, or the output does not show a message like `Error reading waveform data or Bad computed processing interval`, report the problem to maintenance personnel, and skip the following.

(2) If there is output which shows such a message, determine the portion of data available in the time interval in the Data Acquisition WorkFlow and proceed to next step.

d. If it can be concluded that no additional data in the interval will become available, select **Edit Interval** from the interval menu to update the state of the interval to station-done, and skip the following.

e. If the Data Acquisition WorkFlow shows a significant portion of the missing data in the interval has now become available, select **Process** from the interval menu in the Pipeline WorkFlow.

f. If the processing again fails with the same message, there is likely a data quality problem within the interval, in which case select **Edit Interval** from the interval menu and update the state of the interval to station-done.

5-17. AN ISOLATED INTER-PROCESS COMMUNICATIONS ERROR OCCURRED.

5-18. To determine if the pipeline missed a processing request message or a processing completed message for an interval, causing the processing state of the interval to not change, perform the following:

a. If the state of the process is queued, the processing request message to the Process Manager (PM) was probably lost. Select **Process** from the interval menu in the Pipeline WorkFlow to send a new request message to the PM.

(1) If the interval is processed, the problem is solved and the following can be skipped.

(2) If the interval will not process, refer to paragraph c. to restart the PM.

b. If the state of the process is not queued, select the **Monitor** items from the menu of the incompletely processed interval in the Pipeline WorkFlow in a sequence starting from the bottom of the menu. Search for the last process that ran for the interval (i.e. produced some amount of log output).

(1) If the output of the last process that ran indicates that the process ran to completion several minutes ago, then refer to paragraph c. to restart the PM.

(2) If the output does not indicate that the process completed, wait for the process to either complete or fail. If it fails, continue troubleshooting IAW table 5-1.

c. Select **Stop** from the menu of the PM process in the Pipeline Launch, then select **Process** from the menu of each hung interval associated with the PM in Pipeline WorkFlow. The PM should soon restart automatically.

5-19. DMAN IS HUNG OR ALL INTER-PROCESS COMMUNICATIONS ARE FAILING.

5-20. The status of inter-process communications is reflected in the dman log, where a record is kept of each message sent between two pipeline processes (i.e., the message sent when a tis process awakens each 60 seconds). To determine if either the dman or the inter-process communications have stopped, perform the following:

a. Select **Monitor** from the menu of the dman process in the Pipeline Launch.

b. If the output shows regular status updates for at least the tis processes, there is no problem with either the dman or inter-process communications. Continue troubleshooting IAW table 5-1.

c. If the output shows no new lines for at least 60 seconds, there may be a problem with the dman process. Select **Stop** from the menu of the dman process in the Pipeline Launch, then select **Start** to restart the dman process.

(1) If new lines begin to appear after the dman process initializes, the problem is solved and step d. can be skipped.

(2) If no new lines appear, the problem is most likely with the inter-process communications. Proceed to step d.

d. Select **Stop** from the menu of the agent process and all PM processes in the Pipeline Launch. Wait for all processes, except for Isis and the cron processes, to terminate, then follow normal procedures to restart all pipelines.

5-21. STATION DATA WAS LATE FOR NETWORK PROCESSING.

5-22. To determine if a network processing interval should be reprocessed, perform the following:

a. If only a few station intervals are late and it is estimated that the late data will probably not cause missed events in the automated bulletin, it can be left to the SEA1 to incorporate the late arrivals.

b. If several station intervals are late, and the SEA1 analyst can wait for additional network processing to complete, select **Process** from the menu of the affected network intervals.

5-23. ARS IS HUNG WITH A BAD COMMAND SEQUENCE.

5-24. To determine if Analyst Review Station (ARS) can be taken out of the busy state, perform the following:

a. Raise the ARS scheme window and enter the following command to force ARS to return control to the analyst:

```
(show-busy-cursor nil)
```

b. Attempt to continue interacting normally with ARS.

(1) If ARS responds to requests, then the problem is solved.

(2) If ARS does not respond, press **<Control>c** in the scheme window to terminate ARS, and launch ARS from the dman **Launch** menu.

5-25. EVALUATOR PIPELINE IS FAILING.

a. If the state of the process is not queued, select the **Monitor** items from the menu of the incompletely processed interval in the Pipeline WorkFlow in a sequence starting from the bottom of the menu.

b. Search for the last process which ran for the interval (i.e., produced some amount of log output).

(1) If the output of the last process which ran indicates the process ran to completion several minutes ago, refer to paragraph 5-17. c. to restart the PM.

(2) If the output does not indicate the process completed, wait for the process to either complete or fail.

(a) If the process completes, the problem should be resolved.

(b) If the process fails, continue troubleshooting IAW table 5-1.

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CHAPTER 6

ILLUSTRATED PARTS BREAKDOWN

6-1. INTRODUCTION.

6-2. For the Illustrated Parts Breakdown (IPB) and Group Assembly Parts List (GAPL), refer to chapter 6 of TI 2-NDC-2.

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CHAPTER 7

CIRCUIT DIAGRAMS

7-1. INTRODUCTION.

7-2. For the wiring table and circuit diagrams, refer to chapter 7 of TI 2-NDC-2.

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